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ABSTRACT

This curriculum guide provides a model for a postsecondary electronic technology program. It is divided into 10 sections. Section 1 overviews the philosophy, purpose, and goals for vocational education in Georgia. Contents of section 2 include a definition of the guide's purpose and program objective. Section 3 describes the occupational field, discusses employability skills, and provides information on exit points and task listing by Dictionary of Occupational Title code. Examples of a curriculum structure and course outline are provided in section 4. Section 5 contains the unit guides for 14 courses and 140 units/tasks. Each task contains the following information: task, performance objective, instructional activities, suggested instructional materials, evaluation, and classroom hours. Topics covered include tools, safety, and equipment; measurement and calculation (direct and alternating current); testing subassemblies; equipment maintenance; and designing electronic circuitry. Section 6 includes an instructional resource matrix, list of textbooks, suppliers of materials, and additional instructional resources. Forms for recording student progress are provided in section 7. Section 8 addresses working with special needs students. Sections 9 and 10 contain facility layouts and definitions of terms. (YLB)

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ELECTRONIC TECHNOLOGY

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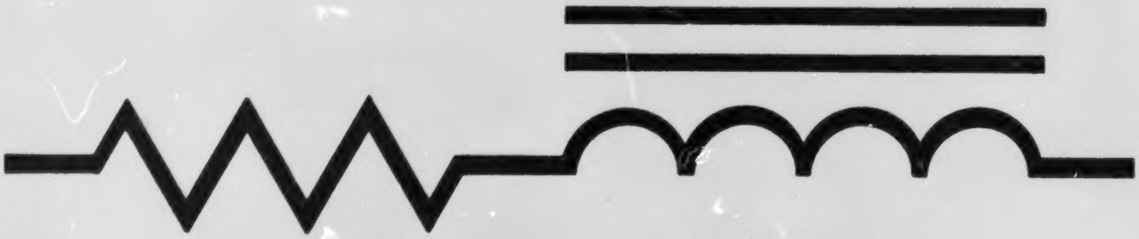

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CURRICULUM GUIDE

Georgia Department of Education

ELECTRONIC TECHNOLOGY

Developed Under Contractual Agreement with

Division of Program Development
Office of Vocational Education
Georgia Department of Education
Atlanta, Georgia 30334
Charles McDaniel, State Superintendent of Schools
1981

ELECTRONIC TECHNOLOGY

Developed By

The University of Georgia

Under the Direction of

Dr. Paul Scott

Vocational Education Materials Center

Division of Vocational Education

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POLICIES AND PROCEDURES FOR THE CENTER

PURPOSE OF THE CENTER

The Vocational Education Materials Center functions within the Division of Vocational Education, University of Georgia. This Center operates under grants from the U.S. Office of Education, and the Georgia State Department of Education with the support of the College of Education. The Center is comprehensive in its commitment and approach to the development and dissemination of materials in the broad field of Vocational Education.

The purpose of the Center is to increase the capability of Georgia's delivery system for Vocational Education. Specifically, the Center is committed to:

1. Develop materials to assist in the implementation of proposed curricula and to enhance the teaching of Vocational Education.
2. Conduct and report curriculum research related to Vocational Education.
3. Provide a production and dissemination center for Vocational Education materials.
4. Provide direct experiences in curriculum development and diffusion for advanced graduate students.
5. Enable faculty members to participate in the development and implementation of a variety of curriculum materials.

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-Foreword-

It has been the privilege of the Division of Vocational Education, University of Georgia, to participate in the development of 48 curriculum guides for Georgia vocational education programs. This work was sponsored by the Division of Program Development, Office of Vocational Education, State Department of Education. The completion of these guides meets a long standing need to provide a comprehensive curriculum overview of the vocational education programs available in Georgia schools. This developmental activity involved one of the largest professional staffs ever assembled for such work. Numerous teachers, teacher educators and state staff members have either written parts of the guides or served on the field review teams. These professionals were supported by a myriad of technical people and a host of typists who literally worked from dawn to dusk to ensure that the guides were produced in a timely fashion.

Be assured that this guide is not intended to be your curriculum or the curriculum of any school. The purpose of this project staff, and I am sure of the state OVE staff, is to offer a guide with supporting resources and teaching ideas from which the vocational instructor can extract a curriculum that meets local needs. The guide, however, does simplify curriculum decisions concerning sequencing and the selection of resources and media support.

The Task Linkage Project and appropriate V'TECS catalogs were used as the beginning point for this guide and all of the others. To assure that these task listings were directly related to Georgia vocational education programs and industry, they were subjected to additional study and review by appropriate teachers.

At some point in the future, this guide will need to be revised. To ensure that such a revision truly reflects the needs of Georgia's vocational education programs, the developers need your reactions, comments and ideas. We will also be interested in how you use the guide. Let us hear from you.

Paul Scott
Curriculum Guide Projects I & II

SECTION I

PHILOSOPHY & GOALS

VOCATIONAL EDUCATION IN GEORGIA

A. PHILOSOPHY

The Georgia Board of Education perceives vocational education as a vital component in the education of the young and adult citizens of this State. Appropriate programs of vocational education and ancillary services should be made readily available to individuals in middle schools, high schools, postsecondary area vocational-technical schools, vocational divisions of junior colleges, vocational centers, the Quick Start program and other adult programs designed to train or retrain workers for useful and satisfying employment.

Special services and assistance must be provided to those who need it in order to participate or benefit from vocational education. This includes women, minorities, the displaced homemaker and other displaced workers, those with limited English-speaking ability, the disadvantaged and the handicapped.

Since men and women spend the greater part of their lives at some form of work, the State should provide opportunities for all its citizens to develop the knowledge, skills and attitudes necessary for them to secure personally satisfying and socially useful employment.

B. PURPOSE

The purpose of vocational education shall be to improve the economic well-being of Georgia citizens by preparing individuals, through organized learning experiences, to select, obtain and advance in recognized occupations.

POSTSECONDARY VOCATIONAL EDUCATION

A. PURPOSE

The purpose of postsecondary vocational-technical education in Georgia is to improve the economic well-being of adult citizens by providing access to high quality vocational-technical training for skilled and semi-skilled occupations, for improvement of existing skills or for retraining in a new occupation.

B. OBJECTIVES

1. To provide vocational-technical education programs and ancillary services commensurate with the needs and interests of students and available job opportunities.

2. To provide vocational-technical education programs which are current with the state-of-the-art, competency-based, and offer multiple exit points to accomodate the students' occupational objectives.

3. To provide vocational-technical education programs which are articulated with available high school counterparts, to facilitate an easy transition from secondary to postsecondary levels without loss of credit.

4. To provide vocational-technical education programs such that 75% of those individuals who leave or complete a program of occupational preparation will find employment in the field, or a related field, for which trained.

5. To provide those guidance, counseling, financial aid, evaluative, job placement, remedial and other supportive programs and services needed by students to enroll, complete a program and become, or remain, employable in a skilled or semi-skilled occupation.

6. To provide needed assistance to special populations to include women, minorities, limited English-speaking, the displaced homemaker and other displaced workers, the disadvantaged and the handicapped.

7. To provide vocational-technical education programs for full-time and part-time students on campus during the day as well as the evening hours, and to provide appropriate programs for full-time and part-time students off campus in businesses and industries, comprehensive high schools and other locations within the respective schools' service areas.

8. To serve as a center for the delivery of postsecondary and adult vocational-technical education programs and services for the community and assigned service area.

STATEMENT OF LOCAL SYSTEM PHILOSOPHY, PURPOSE AND GOALS FOR VOCATIONAL EDUCATION

(This page is intentionally left blank so that local systems may insert their copy of philosophy, purpose and goals for vocational education.)

SECTION II

PURPOSE & OBJECTIVES

PURPOSE OF GUIDE

The purpose is defined in terms of the functional needs of each of the identified classes of users in the secondary and post secondary systems.

(a) Vocational teachers.

1. Provide a guide for organizing their program of instruction,
2. Assist in establishing program objectives,
3. Serve as a curriculum materials resource guide,
4. Improve communications with employers and advisory committees,
5. Facilitate competency based instruction,
6. Facilitate either group or self-paced instruction,
7. Include content by quarter and semester,
8. Cross-reference with existing state developed instructional materials (PLACE packages and post secondary II.).

(b) Vocational supervisors and administrators.

1. Assist in defining the scope and content of their programs,
2. Provide a means to improve curriculum management functions,
3. Serve as a guide for admissions and job placement functions,
4. Improve communications with employers and advisory committees.

(c) Counseling and guidance staff.

1. Provide a data base for counseling and guidance personnel,
2. Identify student exit points (Career Options),
3. Serve as guide for admissions and job placement,
4. Correlate with the new State Board of Education graduation requirements,
5. Provide specific content sequencing by quarter and semester for student scheduling,
6. Provide (a) curriculum options for the disadvantaged handicapped student, (b) curriculum modifications for SPECIAL NEEDS students, (c) typical admission requirements for regular and SPECIAL NEEDS students.

(d) Local Curriculum Coordination Committees.

1. Serve as a guide in working out articulation arrangements,
2. Improve definitions of the relationship between secondary clusters and post secondary specialized programs.

This guide will serve as an ideal communication device between school personnel and the craft advisory committee. By personally reviewing the guide with the local craft advisory committee the teacher will be able to maintain the accuracy of the guide in terms of the local job market and will also be able to inform representatives of local industry regarding the content of the program itself.

ELECTRONIC PROGRAM OBJECTIVE

Given appropriate instruction, as suggested by this guide, a student completing the program should demonstrate entry level skills in Electronic Technology in the areas of knowledge, theoretical structure, tool usage, diagnostic ability, related supportive skills and occupational survival skills.

As the student progresses through the program, sufficient competencies will be acquired to enable the student to enter the occupational field at the following curriculum exit points.

Wirer (Computer)	(D.O.T. Code 729.281-018)
Electronics Assembler	(D.O.T. Code 726.684-018)
Electronics Utility Worker	(D.O.T. Code 726.361-010)
Electronics Tester II	(D.O.T. Code 726.684-026)
Production Repairer	(D.O.T. Code 726.381-014)
Assembly Technician (Computer)	(D.O.T. Code 633.261-010)
Radiotelephone Operator	(D.O.T. Code 193.262-034)
Electronics Tester I	(D.O.T. Code 726.281-014)
Electronics Mechanic	(D.O.T. Code 828.281-010)
Radio Electrician	(D.O.T. Code 823.281-014)
Radio Mechanic	(D.O.T. Code 823.261-018)
Electronics Technician	(D.O.T. Code 003.161-014)

SECTION III

D. O. T. DESCRIPTION, EXIT POINTS, TASKS

DESCRIPTION OF OCCUPATIONAL FIELD

The primary purpose of this section is to provide a general orientation to the occupational field. This orientation may be used by counseling and guidance staff in helping students to select subject areas. It may also be used by instructors for new students just entering the program area. The description delimits the scope of the occupational field in terms of the range of activities involved in a series of occupations. It contains information about career potential within the occupational field, including job market conditions and trends.

The description identifies prerequisite skills and knowledge for those students interested in entering the occupational field. In addition, the Description of Occupational Exit Points is provided to aid the instructor in identifying possible jobs for early leavers. A listing of employability skills is also included in this section.

ELECTRONIC TECHNOLOGY*

Nature of the Work

The electronics industry dates back to the early 1900's when the first radios were produced. By 1930, the industry had expanded its research to include, for example, the development of crude television pictures in color. It wasn't until World War II, however, that electronics production really began to diversify. Efforts to develop a wide range of military products resulted in scientific advances such as electronic measuring and detecting equipment, air flight control equipment, and the digital computer. Today, the industry produces about 30,000 types of electronic goods.

The electronics industry is divided into four main market areas: Government products, industrial products, consumer products, and components. Products sold to the government make up a large portion of electronic sales and include a wide array of items, such as missile and space guidance systems, communications systems, and other electronic goods used in medicine, education, crime detection, and traffic control. Industrial purchases include computers, radio and television broadcasting equipment, telecommunications equipment, electronic office equipment, and production control equipment--all vital to daily business operations.

Consumer products are probably the most familiar types of electronic products. Every day thousands of people buy television sets, radios, stereos, and calculators. No electronic products could be developed, however, without their main ingredient--components. Some of the most well-known components are capacitors, switches, transistors, relays, television picture tubes, and amplifiers.

Electronics manufacturing calls for a variety of jobs. Assemblers, most of whom are semiskilled workers, make up the largest group of employees. Most end products are assembled by hand with small tools--such as pliers and wire cutters--soldering irons, and light welding machines. Assemblers use diagrams to guide their work. Some assembly is done by following instructions presented on color slides and tape recordings. Projectors flash a picture of an assembly sequence on a screen while the assembler listens to recorded directions.

Precision assemblers and electronics technicians install components and subassemblies in complex products such as missiles. They also help make experimental models. Most of these workers are employed in the manufacture of military and industrial electronic equipment.

Machines are used in some assembly work. For example, in putting together circuit boards, automatic machines often are used to position components on boards and to solder connections. Here the assemblers work as machine operators or loaders. Machines assemble most components which involve simple and repetitive operations, including some types of miniaturized semiconductors made with parts small enough to pass through a needle's eye.

Some items, such as television picture tubes and some types of resistors and diodes, need to be assembled by hand. As components move down the production line, assemblers may perform a single operation or put together complete components. Tiny parts are assembled under magnifying lenses or microscopes. Precision welding equipment may be used to weld connections in microminiature components and circuit assemblies.

Some inspections jobs require electronics technicians who have years of experience. These jobs are commonly found in complex production work such as the manufacture of computers and spacecraft. Most inspectors, however, do not need extensive technical training.

Technicians in the electronics industry develop, manufacture, and service electronic equipment and systems. The types of equipment range from radio, radar, sonar, and television to industrial and medical measuring or control devices, navigational equipment, and computers. Because the field is so broad, technicians often specialize in one area, such as automatic control devices or electronic amplifiers. Furthermore, technological advancement is constantly opening up new areas of work such as integrated circuit technology.

When working in design, production, or customer service, electronic technicians use sophisticated measuring and diagnostic devices to test, adjust, and repair equipment. In many cases, they must understand the field in which the electronic device is being used. To design equipment for space exploration, for example, they must consider the need for minimum weight and volume and maximum resistance to shock, extreme temperature, and pressure. Some electronics technicians also work in technical sales, while others work in the radio and television broadcasting industry.

In the office machine and computer industry many electronics technicians assist engineers and scientists in research and development, testing and inspecting electronic components, and doing complex assembly work. Some electronics technicians specialize in repairing computers.

Many electronic technicians are employed in the broadcast industry to operate and maintain broadcasting transmitters and other electronic equipment. In small stations technicians may perform a variety of duties.

Most electronics technology occupations are specialized and will probably require a training period to acquaint new technicians with any special applications and/or problems associated with the use of electronics in that occupation.

Working Conditions

Working conditions in electronics manufacturing compare favorably with those in other industries. Plants usually are well lighted, clean, and quiet. Many plants are relatively new, and are located in suburban and semirural areas. The work in most occupations is not strenuous but assembly-line jobs may be monotonous. The injury rate in electronics manufacturing has been far below the average in manufacturing as a whole, and injuries usually have been less severe.

In the design and repair of electronics equipment work places are usually comfortable and well lighted. The maintenance and repair of commercial two-way radio (radio mechanic) may require outdoor repair in uncomfortable conditions.

Places of Employment

About 1.3 million persons were employed in the development, production, and sales of these products in 1978. Over half of them worked in plants that produced end products for government, industrial, and consumer use. The rest worked in plants that made electronic components.

Training, Other Qualifications, and Advancement

Training requirements for jobs in electronics manufacturing plants range from a few hours of on-the-job training to years of specialized preparation.

Technicians generally need specialized training to qualify for their jobs. Most electronics technicians attend technical schools. High school graduates who have had courses in mathematics and science are preferred for apprenticeship programs.

Some workers advance to electronics technician positions from such jobs as laboratory assistant. A relatively small number of plant workers become technicians.

Electronics technicians need good color vision, manual dexterity, and good eye-hand coordination. Some technicians who test radio transmitting equipment must hold licenses from the Federal Communications Commission as first- or second-class commercial radio-telephone operators. Assemblers, testers, and inspectors need good vision, good color perception, manual dexterity, and patience.

Employment Outlook

Employment growth patterns will vary among the different sectors of the industry. While employment in some areas is expected to grow faster than the average for all industries through the 1980's, employment in other areas either will grow more slowly or possibly decline. In addition to the jobs resulting from employment growth, large numbers of openings will arise in all areas as experienced workers retire, die, or take other jobs.

Production of industrial electronic products will increase as businesses buy more computers and other electronic equipment to automate paperwork and production processes. Business spending for electronic communication and testing equipment also will grow. Although the demand for television sets, video tape recorders, stereo systems, calculators, and two-way car radios will rise as population and personal incomes grow, the increasing level of imports may adversely affect productions. Government purchases for defense will continue to account for a large proportion of electronics manufacturing output. An increasing share of government purchases, however, is likely to be for electronic equipment used in medicine, energy conservation, education, and pollution abatement.

Employment in the electronics industry may fluctuate from year to year, because of changes in economic activity and defense spending. As a result, job openings may be plentiful in some years, scarce in others.

Employment growth also will vary among occupational groups and individual occupations. For example, employment of skilled maintenance workers and service technicians is expected to rise at a more rapid rate than total employment because of the need to repair the increasing amount of complex machinery used to produce goods, or sold to consumers. On the other hand, employment of assemblers probably will rise at a slower rate because of the growing machanization and automation of assembly line operations.

Employment of engineers, scientists, and technicians is expected to increase faster than total employment, because of continued high expenditures for research and development and the manufacture of more complex products.

Sources of Additional Information

Information about careers in this field can be obtained from the public relations departments of electronics manufacturing companies and from:

Electronics Industries Association, 2001 Eye St. NW., Washington, DC 20006.

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*Occupational Outlook Handbook, 1980-81 Edition

*RELATED OCCUPATIONS

729.281-042 WIRER

Installs, adjusts, and repairs wiring and cables in punched card office machines and adding machines according to wiring diagrams, blueprints, and engineering specifications, using handtools, soldering iron, and plugging gun. Reads wiring diagrams, blueprints, wire routing and standards sheets, and engineering specifications to determine lengths, types, routing, and colors of wiring and cables to be installed in machines, such as collators, adding machines, reproducing punches, card reader punches and interpreters. Selects specified wires and cables, routes according to instructions, and fastens connections by bolting, screwing, soldering, or plugging, using wrenches, screwdrivers, soldering iron and plugging gun (pneumatic gun that forces plug ends of wires into jacks). Inspects previously wired units, such as plugboards, fuse holders, keyboards, and indicator lights, for conformance to specifications, using test devices, such as voltmeters and ohmmeters.

726.684-018 ELECTRONICS ASSEMBLER

Assembles electronic components, subassemblies, and systems by any one or combination of the following methods. Reads work orders, follows production drawings and sample assemblies, and receives verbal instructions regarding duties to be performed. Positions and alines parts in specified relationship to each other in jig, fixture, or other holding device, using tweezer, vacuum probe, or hand instruments. (1) Tends machines or uses handtools and power tools to crimp, stake, bolt, rivet, weld, solder, cement, press fit, or perform similar operation to secure parts in place. (2) Mounts assembled components such as transformers, resistors, capacitors, integrated circuits, and sockets on chassis, panel, or printed circuit board. (3) Connects component lead wires between individual component leads and other components, connectors, terminals, and contact points using soldering, welding, thermocompression, or related bonding procedures. (4) Installs finished assemblies or subassemblies in cases and cabinets. (5) Assembles and attaches functional and cosmetic hardware such as caps, clamps and knobs to assemblies using handtools and power tools. (6) Performs intermediate assembly tasks such as potting, encapsulating, cleaning, coating, epoxy bonding, curing, stamping, etching, impregnating, and color coding parts and assemblies. (7) Tends machines which press or shape component parts such as contacts, shells and insulators. (8) Tends automatic assembly equipment which joins components and parts. (9) Winds capacitors on manual or automatic winding equipment. (10) Adjusts or trims material from components such as capacitors and potentiometers to change electronic characteristic to specification measured by electronic test instrument. (11) Performs on-line go-not-go testing and inspection using magnifying devices, fixed and moveable measuring instruments and electronic test equipment to insure parts and assemblies meet production specifications and free from defects. May perform assembly operations under microscope or other magnifying device. Specific titles may be assigned which designate product, subcomponent, equipment used, or processes.

726.361-010 ELECTRONICS UTILITY WORKER

Arranges layout of work station for other workers who fabricate, process, or assemble electronic equipment, and components, such as semiconductor devices, printed circuit boards, chassis assemblies, and wire harnesses and cables. Reads specifications, such as process guide, bill of material, wiring diagram, mechanical print, and schematic diagram to determine equipment needed, such as piece parts, chemicals and gases, tools, test instruments and jigs and fixtures, for work stations. Prepares and submits requisition. Positions equipment in specified arrangement at work stations. Notifies stockroom when stations need resupply of materials, such as chemicals, resistors, transistors, and color coded wire, during processing or assembly operations. May assist workers to follow new work procedures, and relieve operators from work stations. May set and adjust controls for processing, fabricating, and assembly line equipment, such as furnaces, process chambers, power supplies, timers and multimeters. May test and repair assembled items by removing or adding piece parts, or resoldering or rebonding defective connections, using handtools, production equipment, test machines and test instruments, such as meters, resistance bridges and automatic component testers.

726.684-026 ELECTRONICS TESTER (electronics) II component tester; production tester; quality-control tester; testing-machine operator.

Tests electronic function of assemblies, components and parts, using standard test equipment and procedures. Connects unit to test instrument, such as ohmmeter, voltmeter, ammeter, resistance bridge, or oscilloscope and turns switch. Reads instrument dial or scope that indicates resistance, capacitance, continuity, and wave pattern or defect, such as short or current leakage. Compares instrument reading with standard and rejects defective units. Records type and quantity of defect. May verify dimensions of parts, using standard gages. May examine assembly, component or part for defects, such as short leads, bent plate, or cracked seal. May bend equipment to subject unit to stress and strain prior to testing. May operate X-ray photograph and closed circuit television viewing equipment to observe internal image of unit for assembly defect prior to testing. May adjust circuits in radio and television receivers for maximum signal response.

726.381-014 PRODUCTION REPAIRER

Repairs rejected electronic equipment, such as radio and television receivers, radio transmitters, radar units, amplifiers and related antenna and cable assemblies, according to product specifications, manufacturing instructions and diagrams, using handtools and soldering iron. Reads inspection tag and examines unit to locate defects, such as broken wires, burned-out components, or scratches on cabinet. Removes broken wires from units, using soldering iron and pliers. Cuts new wires to specified lengths with wire cutters, or obtains precut wires and solders them to specified terminals. Reroutes and solders color-coded wires to terminals, following wiring diagram. Repairs defectively soldered joints, using soldering iron. Removes defective connectors from chassis, and installs new components, using soldering iron and handtools. Brushes touch-up paint over cabinet or case, and protective varnish on exposed wiring.

633.261-010 ASSEMBLY TECHNICIAN

Inspects, adjusts, and repairs punched-card office machines, such as interpreters, collators, proof machines for banks, and card punches, using handtools and test equipment. Reads machine assembly specifications, such as charts, blueprints, schematic diagrams, and engineering specifications to determine requirements, such as drive speed, timing of card feed and output, and installation of special features ordered by customer. Operates machine, using prepunched cards, to observe and listen to operation of moving parts, to measure clearances and contact gaps, and to measure voltages and continuity, using voltmeter, ohmmeter, and test lights. Adjusts clearance of moving parts, electrical contact gaps, and alinement of printing units and contact brush units to meet specifications, using tools, such as screwdrivers, wrenches, feeler gages and special fixtures. Repairs assembly errors noted by quality control personnel. May install hardware, drill holes, and insert pins to complete assembly prior to final testing of machine. May train workers in assembly operations.

193.262-034 RADIOTELEPHONE OPERATOR (any ind.) phone-circuit operator; radiophone operator; radiotelephone-technical operator.

Operates and keeps in repair radiotelephone transmitter and receiving equipment for commercial communication. Throws switches to cut in power to stages of transmitter. Cuts in antennas and connects transmitting and receiving equipment into telephone system. Turns controls to adjust voice volume and modulation, and to set transmitter on specified frequency. Conducts routine tests and repairs transmitting equipment, using electronic testing equipment, handtools, and power tools, to maintain communication system in operative condition. Must hold Radiotelephone Operator's License issued by Federal Communications Commission.

726.281-014 ELECTRONICS TESTER (electronics) I technician, test systems; test technician; tester, systems; trouble shooter; quality-control-assembly-test technician.

Performs a variety of electronic, mechanical, and electromechanical tests on electronic systems, subassemblies, and parts to insure unit functions according to specifications or to determine cause of unit failure, using range of electronic test instruments. Reads test schedule, workorders, test manuals, performance specifications, wiring diagrams, and schematics to ascertain testing procedure and equipment to be used. Performs functional tests of systems, subassemblies and parts under specified environmental conditions, such as temperature change, vibration, presssure, and humidity, using devices such as temperature cabinets, shake-test machines and centrifuges. Calibrates test instruments according to specifications. Connects unit to be tested to equipment such as signal generator, frequency meter, or spectrum analyzer. Reads dials that indicate electronic characteristics, such as voltage, frequency, distortion, inductance, and capacitance. Compares results with specifications and records test data or plots test results on graph. Traces circuits of defective units, using knowledge of electronic theory and electronic test equipment to locate defects, such as shorts or faulty components. Replaces defective wiring and components using handtools and soldering iron or records defects on tag attached to unit and returns it to production department for repair. May examine switches, dials and other hardware for conformance to specifications. May verify dimensions of pins, shafts, and other mechanical parts, using calipers, vernier gages and micrometers. May operate X-ray equipment to verify internal assembly and alinement of parts according to specifications. May calibrate unit to obtain specified dial reading of characteristics, such as frequency or inductance. May devise test equipment set-up to evaluate performance and operation of nonstandard or customer returned units.

828.281-010 ELECTRONICS MECHANIC (any ind.) communication technician; electronics-equipment mechanic; electronics specialist; electronics-system mechanic; electronics technician.

Repairs electronic equipment, such as computers, industrial controls, radar systems, telemetering and missile control systems, transmitters, antennas, and servomechanisms, following blueprints and manufacturer's specifications, and using handtools and test instruments. Tests faulty equipment and applies knowledge of functional operation of electronic units and systems to diagnose cause of malfunction. Tests electronic components and circuits to locate defects, using oscilloscopes, signal generators, ammeters and voltmeters. Replaces defective components and wiring and adjusts mechanical parts, using handtools and soldering iron. Alines, adjusts, and calibrates equipment according to specifications. Calibrates testing instruments. Maintains records of repairs, calibrations and tests. May install equipment in industrial or military establishments and in aircraft and missiles control systems in ground and flight tests, and be required to hold license from governmental agency.

823.281-014 ELECTRICIAN, RADIO (any ind.) radio communications mechanician; radio mechanic; station mechanic.

Adjusts, installs, tests, and repairs high-powered stationary and mobile radio transmitting equipment, using handtools and testing instruments and following wiring diagrams. Adjusts controls and tests frequencies of transmitters, using frequency meter. Listens to radio range station at frequent intervals during broadcasts to detect flaws in transmission and adjusts controls to eliminate flaws. Operates emergency truck transmitter to insure its readiness for immediate use. Examines equipment and replaces defective condensers, switches, tubes and transistors. Tests equipment with instruments, such as circuit analyzers, audiometers and voltmeters. Repairs components of radio transmitting equipment and intercommunication telephone system, using handtools.

823.261-018 RADIO MECHANIC

Tests and repairs radio transmitting and receiving equipment in accordance with diagrams and manufacturer's specifications, using handtools and electrical measuring instruments. Examines equipment for damaged components and loose or broken connections and wires. Replaces defective components and parts, such as tubes, condensers, transformers, resistors, and generators, using handtools. Solders or tightens loose connections and cleans and lubricates motor generators. Tests equipment for factors such as power output, frequency power, noise level, audio quality, and dial calibration, using oscilloscopes, radio frequency and watt meters, ammeters, voltmeters and tube testers. Tests batteries with hydrometer and ammeter and charges batteries. Inserts plugs into receptacles and bolts or screws leads to terminals to connect radios and equipment to power source, using handtools. Turns setscrews to adjust receivers for sensitivity and transmitters for maximum output. Required to have Federal Communications Commission Radiotelephone Operator's License. May install, test, adjust, modify and repair intercommunication systems. May specialize in testing and repairing radio transmitting and receiving equipment in motor vehicles and commercial and governmental establishments.

003.161-014 ELECTRONICS TECHNICIAN

Applies electronic theory, principles of electrical circuits, electrical testing procedures, engineering mathematics, physics, and related knowledge to lay out, build, test, troubleshoot, repair, and modify developmental and production electronic equipment, such as computers, missile-control instrumentation and machine tool numerical controls. Discusses layout and assembly problems with electronics engineer and draws sketches to clarify design details and functional criteria of electronic units. Assembles experimental circuitry (breadboard) or complete prototype model according to engineering instructions, technical manuals, and knowledge of electronic systems and components and their functions. Recommends changes in circuitry or installation specifications to simplify assembly and maintenance. Sets up standard test apparatus or contrives test equipment and circuitry, and conducts functional operational, environmental, and life tests to evaluate performance and reliability of prototype or production model. Analyzes and interprets test data. Adjusts, calibrates, aligns, and modifies circuitry and components and records effects on unit performance. Writes technical reports and develops charts, graphs, and schematics to describe and illustrate systems operating characteristics, malfunctions, deviations from design specifications, and functional limitations for consideration by professional engineering personnel in broader determinations affecting systems design and laboratory procedures. May operate bench lathes, drills, and other machine tools to fabricate non-procurable items, such as coils, terminal boards and chassis. May check out newly installed equipment in airplanes, ships and structures to evaluate system performance under actual operation conditions. May instruct and supervise lower grade technical personnel

EMPLOYABILITY SKILLS

In addition to the aptitudes, abilities, interests, physical requirements and job skills listed in the preceding Description of Occupation, employability skills exert a great deal of influence on a person's ability to get and keep a job. Surveys indicate that more people lose their jobs because of poor attitudes toward their job than for lack of job skills. For this reason it is important that information concerning the following employability skills be provided as an ongoing part of the program.

1. Getting a job
    a. Filling out job applications
    b. Developing a resume
    c. Preparing for a job interview

2. Keeping a job
    a. Be on time and regular in attendance
    b. Maintain a fair share of the work-load
    c. Work without supervision
    d. Meet production schedules
    e. Properly care for and use equipment
    f. Dress appropriately for the job
    g. Maintain good personal hygiene
    h. Develop and maintain good communication with supervisors and co-workers

A recent study sponsored by the Illinois Department of Adult, Vocational and Technical Education and conducted by the University of Illinois, "Survival Skills: Mastering the Human Aspects of Work", has identified twelve topics that might be developed into instructional modules for teaching occupational survival skills. The author, Robert E. Nelson, outlines these topics listed below and on the next page, each followed by a general objective which indicates the relationship between the topic and the survival skills required to maintain a job.

*"1. Working in an Organization: To familiarize students with the reasons for the formation of organizations and the common characteristics of organizations.
2. Understanding Self and Others: To have students develop insights into causes of human behavior and learn to interpret their own behavior and the behavior of others.
3. Motivation for Work: To have students develop an understanding of motivation for work and the ability to build positive motivations into the work they perform.

4. Interpersonal Relations: To have students develop concepts and skills in interpersonal relations and apply them to work situations.
5. On-the-Job Communication: To have students understand the importance of effective communication and learn ways of communicating effectively on the job.
6. Using Creativity on the Job: To make students aware of their creative potential and to practice using their creative ability in hypothetical on-the-job situations.
7. Authority and Responsibility: To have students develop an understanding of the concepts of authority, power, influence, and responsibility as they apply to work situations.
8. Problem Solving: To have students develop skill in applying problem solving to their work.
9. Coping with Organizational Change: To make students aware of the process of organizational change and the techniques for coping with organizational change.
10. Coping with Organizational Conflict: To make students aware of the sources and types of conflicts encountered on the job and recognize ways of coping with conflicts in an organization.
11. Leadership: To have students recognize the need for leadership in work groups and increase their understanding of the leadership role in work situations.
12. Adapting and Planning for the Future: To have students develop perspectives of work in the future and the ability to plan for anticipated changes in their work roles."

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*Abstracted from the article, "Survival Skills: Mastering the Human Aspects of Work," by Robert E. Nelson, American Vocational Journal, November 1977.

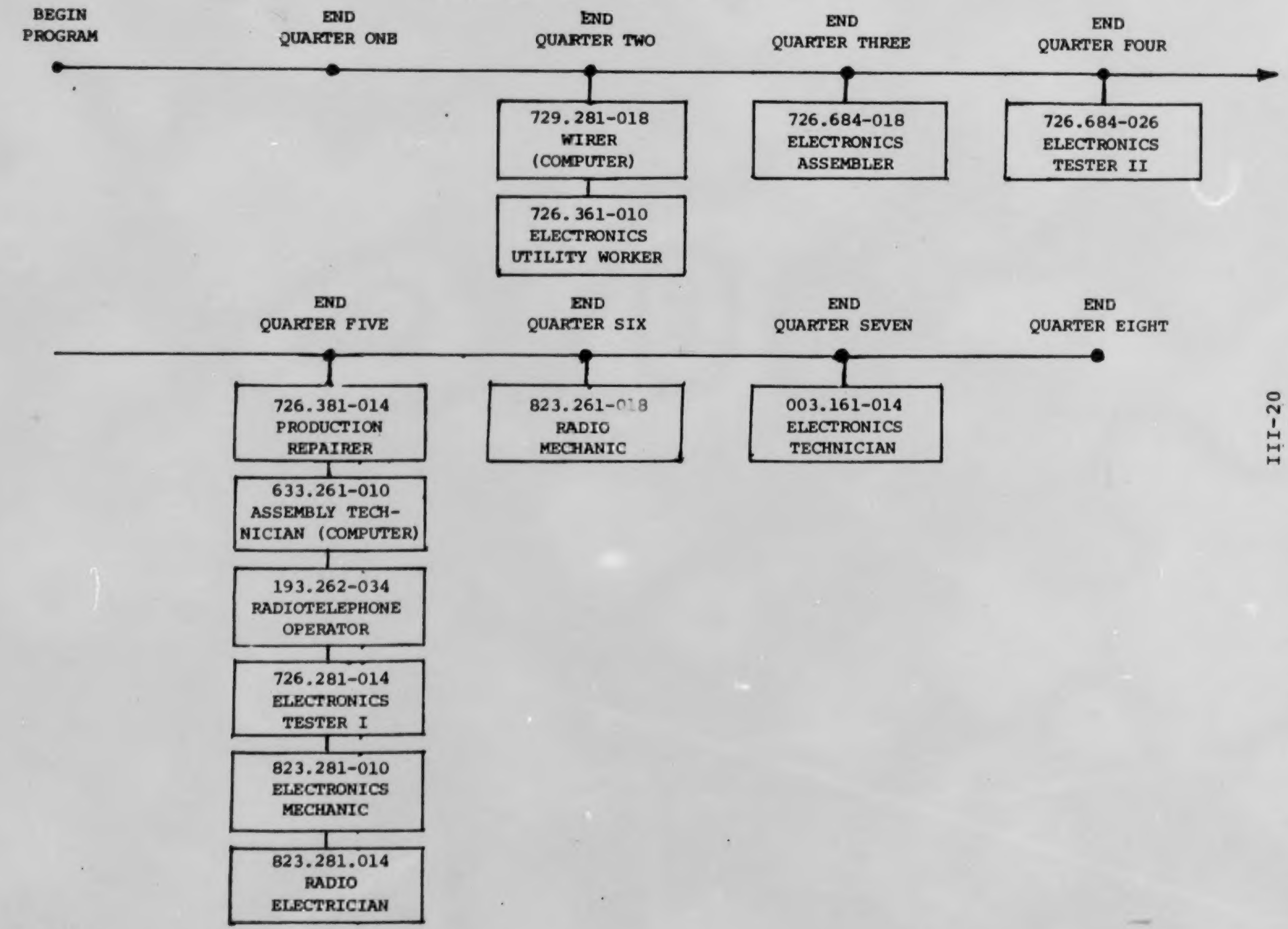
ELECTRONICS TECHNOLOGY EXIT POINTS

The diagram on the following page is based on the Suggested Course Outline Structure. It graphically illustrates the points in the Electronics Technology program where the student should have acquired the competencies necessary for entry level employment into the job classifications indicated. In many cases by the time a student reaches an exit point he/she may have acquired several competencies in addition to those required for the specific job classification.

The course outline is structured to prepare students to become Electronics Assemblers, Electronics Mechanics and Electronics Technicians. Every student, upon leaving a vocational program, should have entry level skills in some related occupation.

The Task Listing by DOT Code indicates the entry level skills (tasks) required for the student to be considered employable in a specified occupation. If the local program is individualized it should be relatively easy to move a potential program leaver (drop out) into those skills (tasks) which would qualify the student for one of the listed occupations.

ELECTRONICS TECHNOLOGY EXIT POINTS


BEGIN PROGRAM
END QUARTER ONE
END QUARTER TWO
END QUARTER THREE
END QUARTER FOUR
729.281-018 WIRER (COMPUTER)
726.361-010 ELECTRONICS UTILITY WORKER
726.684-018 ELECTRONICS ASSEMBLER
726.684-026 ELECTRONICS TESTER II
END QUARTER FIVE
END QUARTER SIX
END QUARTER SEVEN
END QUARTER EIGHT
726.381-014 PRODUCTION REPAIRER
633.261-010 ASSEMBLY TECHNICIAN (COMPUTER)
193.262-034 RADIOTELEPHONE OPERATOR
726.281-014 ELECTRONICS TESTER I
823.281-010 ELECTRONICS MECHANIC
823.281.014 RADIO ELECTRICIAN
823.261-018 RADIO MECHANIC
003.161-014 ELECTRONICS TECHNICIAN

TASK LISTING BY D.O.T. CODE

In this section the occupational exit points from the curriculum are cross referenced with the tasks which are required for employment in each job title. On the line following each task an x appears in the column of each job title to which the task applies. All the tasks listed in this matrix are taught in the curriculum presented in this guide. A detailed treatment of each task appears in the Unit Guides section of this curriculum guide.

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	DOT DESCRIPTIONS: Wirer (Computer) DOT NO.: 729.281-016	Electronics Assembler 726.684-018	Electronics Utility Worker 726.361-010	Electronics Tester II 726.684-026	Production Repairer 726.381-014	Assembly Technician (Computer) 633.261-010	Radiotelephone Operator 193.262-034	Electronics Tester I 726.281-014	Electronics Mechanic 828.281-010	Radio Electrician 823.281-014	Radio Mechanic 823.261-018	Electronics Technician 003.161-014
Duty A:	Operate Hand, Power Tools and Portable Test Equipment												
ET-01	Observing electrical safety precautions	X	X	X	X	X	X	X	X	X	X	X	X
ET-02	Identifying and using hand tools	X	X	X	X	X	X	X	X	X	X	X	X
ET-03	Identifying and using sheet metal tools	X	X	X	X	X	X	X	X	X	X	X	X
ET-04	Identifying and using power tools	X	X	X	X	X	X	X	X	X	X	X	X
ET-05	Identifying and using volt-ohm milliammeters (VOM)	X	X	X	X	X	X	X	X	X	X	X	X
ET-06	Identifying and using electronic-volt meters (EVM)	X	X	X	X	X	X	X	X	X	X	X	X
ET-07	Identifying and using ohmmeters	X	X	X	X	X	X	X	X	X	X	X	X
ET-08	Identifying and using oscilloscopes	X	X	X	X	X	X	X	X	X	X	X	X
ET-09	Identifying and using tube testers	X	X	X	X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer)	Electronics Assembler	Electronics Utility Worker	Electronics Tester II	Production Repairer	Assembly Technician (Computer)	Radiotelephone Operator	Electronics Tester I	Electronics Mechanic	Radio Electrician	Radio Mechanic	Electronics Technician
	DOT NO.	729.281-018	726.684-018	726.361-010	726.684-026	726.381-014	633.261-010	193.262-034	726.281-014	828.281-010	823.281-014	823.261-018	003.161-014
ET-10	Identifying and using transistor analyzers	X	X	X	X	X	X	X	X	X	X	X	X
ET-11	Identifying and using capacitor testers	X	X	X	X	X	X	X	X	X	X	X	X
ET-12	Identifying and using sine wave generators	X	X	X	X	X	X	X	X	X	X	X	X
ET-13	Identifying and using signal generators	X	X	X	X	X	X	X	X	X	X	X	X
ET-14	Identifying and using pulse generators	X	X	X	X	X	X	X	X	X	X	X	X
ET-15	Identifying and using square wave generators	X	X	X	X	X	X	X	X	X	X	X	X
ET-16	Identifying and using impedance testers	X	X	X	X	X	X	X	X	X	X	X	X
ET-17	Identifying and using frequency meters	X	X	X	X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer)	Electronics Assembler	Electronics Utility Worker	Electronics Tester II	Production Repairer	Assembly Technician (Computer)	Radiotelephone Operator	Electronics Tester I	Electronics Mechanic	Radio Electrician	Radio Mechanic	Electronics Technician
	DOT NO.	729.281-018	726.684-018	726.361-010	726.684-026	726.381-014	633.261-010	193.262-034	726.281-014	828.281-010	823.281-014	823.261-018	003.161-014
Duty B:	Identifying and Performing Condition Tests of Electrical and Electronic Components												
ET-18	Understanding fundamentals of electrical theory and electrical measurement		X	X	X	X	X	X	X	X	X	X	X
ET-19	Making calculations using Ohm's law		X	X	X	X	X	X	X	X	X	X	X
ET-20	Measuring current in DC circuits		X	X	X	X	X	X	X	X	X	X	X
ET-21	Measuring voltage in DC circuits		X	X	X	X	X	X	X	X	X	X	X
ET-22	Calculating and measuring resistance in DC circuits		X	X	X	X	X	X	X	X	X	X	X
ET-23	Calculating voltage, current and resistance in DC series circuits		X	X	X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME / DOT DESCRIPTIONS	Wirer (Computer)	Electronics Assembler	Electronics Utility Worker	Electronics Tester II	Production Repairer	Assembly Technician (Computer)	Radiotelephone Operator	Electronics Tester I	Electronics Mechanic	Radio Electrician	Radio Mechanic	Electronics Technician
	DOT NO.	729.281-018	726.684-018	726.361-010	726.684-026	726.381-014	633.261-010	193.262-034	726.281-014	828.281-010	823.281-014	823.261-018	003.161-014
ET-24	Calculating total voltage, total current and total resistance in DC parallel circuits		X	X	X	X	X	X	X	X	X	X	X
ET-25	Calculating and measuring electrical quantities in combination DC circuits		X	X	X	X	X	X	X	X	X	X	X
ET-26	Calculating power in DC circuits		X	X	X	X	X	X	X	X	X	X	X
ET-27	Applying fundamentals of magnetism and electromagnetism		X	X	X	X	X	X	X	X	X	X	X
ET-28	Using test instruments to measure voltage, current and resistance		X	X	X	X	X	X	X	X	X	X	X
ET-29	Calculating values in DC network circuits		X	X	X	X	X	X	X	X	X	X	X
ET-30	Calculating capacitance and time constants for RC circuits		X	X	X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer)	Electronics Assembler	Electronics Utility Worker	Electronics Tester II	Production Repairer	Assembly Technician (Computer)	Radiotelephone Operator	Electronics Tester I	Electronics Mechanic	Radio Electrician	Radio Mechanic	Electronics Technician
	DOT NO.	729.281-018	726.684-018	726.361-010	726.684-026	726.381-014	633.261-010	193.262-034	726.281-014	828.281-010	823.281-014	823.261-018	003.161-014
ET-31	Calculating values for a right triangle		X	X	X	X	X	X	X	X	X	X	X
ET-32	Identifying the characteristics of AC sine waves		X	X	X	X	X	X	X	X	X	X	X
ET-33	Measuring AC values for LF circuits		X	X	X	X	X	X	X	X	X	X	X
ET-34	Determining reactance and impedance of a capacitor in either series or parallel circuits		X	X	X	X	X	X	X	X	X	X	X
ET-35	Calculating and measuring electrical values in AC capacitance circuits		X	X	X	X	X	X	X	X	X	X	X
ET-36	Measuring inductance in series RL circuits		X	X	X	X	X	X	X	X	X	X	X
ET-37	Computing turns, voltage, current and impedance ratios of transformers		X	X	X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer) 729.281-018	Electronics Assembler 726.684-018	Electronics Utility Worker 726.361-010	Electronics Tester II 726.684-026	Production Repairer 726.381-014	Assembly Technician (Computer) 633.261-010	Radiotelephone Operator 193.262-034	Electronics Tester I 726.281-014	Electronics Mechanic 828.281-010	Radio Electrician 823.281-014	Radio Mechanic 823.261-018	Electronics Technician 003.161-014
		DOT DESCRIPTIONS / DOT NO.											
ET-38	Drawing phasor diagrams and calculating operating values for series AC circuits		X	X	X	X	X	X	X	X	X	X	X
ET-39	Drawing phasor diagrams and calculating operating values for parallel AC circuits		X	X	X	X	X	X	X	X	X	X	X
ET-40	Understanding fundamentals of tuned AC circuits		X	X	X	X	X	X	X	X	X	X	X
ET-41	Understanding fundamentals of semi-conductor materials		X	X	X	X	X	X	X	X	X	X	X
ET-42	Performing a condition test of a semi-conductor diode using an ohmmeter		X	X	X	X	X	X	X	X	X	X	X
ET-43	Performing a condition test of zener diodes used in regulator circuits		X	X	X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer)	Electronics Assembler	Electronics Utility Worker	Electronics Tester II	Production Repairer	Assembly Technician (Computer)	Radiotelephone Operator	Electronics Tester I	Electronics Mechanic	Radio Electrician	Radio Mechanic	Electronics Technician
	DOT DESCRIPTIONS / DOT NO.	729.281-018	726.684-018	726.361-010	726.684-026	726.381-014	633.261-010	193.262-034	726.281-014	828.281-010	823.281-014	823.261-018	003.161-014
ET-44	Identifying symbols and electrical characteristics of tunnel, varactor and high frequency diodes		X	X	X	X	X	X	X	X	X	X	X
ET-45	Understanding the fundamentals of bipolar transistors and their electrical characteristics		X	X	X	X	X	X	X	X	X	X	X
ET-46	Performing condition tests of bipolar transistors		X	X	X	X	X	X	X	X	X	X	X
ET-47	Understanding the fundamentals of field effect transistors and their electrical characteristics		X	X	X	X	X	X	X	X	X	X	X
ET-48	Understanding the fundamentals of thyristors and their electrical characteristics		X	X	X	X	X	X	X	X	X	X	X
ET-49	Understanding fundamentals of integrated circuits		X	X	X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

TASK NO.	TASK NAME	POSSIBLE EXIT POINTS											
		DOT DESCRIPTIONS / DOT NO.	Wirer (Computer) 729.281-018	Electronics Assembler 726.684-018	Electronics Utility Worker 726.361-010	Electronics Tester II 726.684-026	Production Repairer 726.381-014	Assembly Technician (Computer) 633.261-010	Radiotelephone Operator 193.262-034	Electronics Tester I 726.281-014	Electronics Mechanic 828.281-010	Radio Electrician 823.281-014	Radio Mechanic 823.261-018	Electronics Technician 003.161-014
ET-50	Defining the operating values and applications of optoelectronic devices			X	X	X	X	X	X	X	X	X	X	X
ET-51	Identifying the component parts and operational characteristics of diode vacuum tubes			X	X	X	X	X	X	X	X	X	X	X
ET-52	Identifying the component parts and operating characteristics of triode vacuum tubes			X	X	X	X	X	X	X	X	X	X	X
ET-53	Identifying the component parts and operating characteristics of tetrode vacuum tubes			X	X	X	X	X	X	X	X	X	X	X
ET-54	Identifying the component parts and operating characteristics of pentode vacuum tubes			X	X	X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer) 729.281-018	Electronics Assembler 726.684-018	Electronics Utility Worker 726.361-010	Electronics Tester II 726.684-026	Production Repairer 726.381-014	Assembly Technician (Computer) 633.261-010	Radiotelephone Operator 193.262-034	Electronics Tester I 726.281-014	Electronics Mechanic 828.281-010	Radio Electrician 823.281-014	Radio Mechanic 823.261-018	Electronics Technician 003.161-014
Duty C:	Identify, Test Condition and Align to Specification Electrical and Electronic Sub-Assemblies												
ET-55	Performing condition testing of the thermal stability and operational parameters of a common-emitter amplifier circuit				X	X	X	X	X	X	X	X	X
ET-56	Performing condition testing of DC and audio amplifiers				X	X	X	X	X	X	X	X	X
ET-57	Defining electrical characteristics, applications and normal operational values of amplifiers				X	X	X	X	X	X	X	X	X
ET-58	Testing an amplifier for amplification				X	X	X	X	X	X	X	X	X
ET-59	Testing and repairing a vacuum tube amplifier				X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer)	Electronics Assembler	Electronics Utility Worker	Electronics Tester II	Production Repairer	Assembly Technician (Computer)	Radiotelephone Operator	Electronics Tester I	Electronics Mechanic	Radio Electrician	Radio Mechanic	Electronics Technician
	DOT NO.	729.281-018	726.684-018	726.361-010	726.684-026	726.381-014	633.261-010	193.262-034	726.281-014	828.281-010	823.281-014	823.261-018	003.161-014
ET-60	Testing and repairing a transistor amplifier				X	X	X	X	X	X	X	X	X
ET-61	Identifying component parts and electrical characteristics of power supply circuits				X	X	X	X	X	X	X	X	X
ET-62	Testing and repairing power supplies				X	X	X	X	X	X	X	X	X
ET-63	Calibrating power supply voltage				X	X	X	X	X	X	X	X	X
ET-64	Constructing and performing a condition test of oscillators				X	X	X	X	X	X	X	X	X
ET-65	Testing and repairing oscillators				X	X	X	X	X	X	X	X	X
ET-66	Testing and repairing clampers				X	X	X	X	X	X	X	X	X
ET-67	Testing and repairing clipper circuits				X	X	X	X	X	X	X	X	X
ET-68	Testing and repairing counters				X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer) 729.281-018	Electronics Assembler 726.684-018	Electronics Utility Worker 726.361-010	Electronics Tester II 726.684-026	Production Repairer 726.381-014	Assembly Technician (Computer) 633.261-010	Radiotelephone Operator 193.262-034	Electronics Tester I 726.281-014	Electronics Mechanic 828.281-010	Radio Electrician 823.281-014	Radio Mechanic 823.261-018	Electronics Technician 003.161-014
ET-69	Constructing and performing condition tests of pulse circuits				X	X	X	X	X	X	X	X	X
ET-70	Testing and repairing nonsinusoidal wave shape amplifiers				X	X	X	X	X	X	X	X	X
ET-71	Identifying electrical characteristics and operating values of amplitude modulators (AM) and AM detectors				X	X	X	X	X	X	X	X	X
ET-72	Identifying electrical characteristics and operating values of frequency modulators (FM) and FM detectors				X	X	X	X	X	X	X	X	X
ET-73	Constructing and performing condition testing of superhetrodyne receivers				X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

	DOT DESCRIPTIONS	Wirer (Computer)	Electronics Assembler	Electronics Utility Worker	Electronics Tester II	Production Repairer	Assembly Technician (Computer)	Radiotelephone Operator	Electronics Tester I	Electronics Mechanic	Radio Electrician	Radio Mechanic	Electronics Technician
	DOT NO.	729.281-018	726.684-018	726.361-010	726.684-026	726.381-014	633.261-010	193.262-034	726.281-014	828.281-010	823.281-014	823.261-018	003.161-014
TASK NO.	TASK NAME												
ET-74	Identifying sequence and electrical characteristics of television signal development, transmission, reception and decoding				X	X	X	X	X	X	X	X	X
ET-75	Identifying the components and electrical characteristics of a low voltage power supply and its protective circuit				X	X	X	X	X	X	X	X	X
ET-76	Performing condition testing on a low voltage power supply				X	X	X	X	X	X	X	X	X
ET-77	Troubleshooting a defective switch-mode secondary voltage supply				X	X	X	X	X	X	X	X	X
ET-78	Troubleshooting defective synchronizing and deflection circuits				X	X	X	X	X	X	X	X	X
ET-79	Troubleshooting defective horizontal output circuits				X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer)	Electronics Assembler	Electronics Utility Worker	Electronics Tester II	Production Repairer	Assembly Technician (Computer)	Radiotelephone Operator	Electronics Tester I	Electronics Mechanic	Radio Electrician	Radio Mechanic	Electronics Technician
	DOT NO.	729.281-018	726.684-018	726.361-010	726.684-026	726.381-014	633.261-010	193.262-034	726.281-014	828.281-010	823.281-014	823.261-018	003.161-014
ET-80	Troubleshooting sweep generator circuits				X	X	X	X	X	X	X	X	X
ET-81	Troubleshooting a defective high voltage supply				X	X	X	X	X	X	X	X	X
ET-82	Troubleshooting electrical circuits				X	X	X	X	X	X	X	X	X
ET-83	Performing physical and electrical alignment of the picture tube and its associated circuits				X	X	X	X	X	X	X	X	X
ET-84	Troubleshooting a defective vertical deflection circuit				X	X	X	X	X	X	X	X	X
ET-85	Adjusting circuit operational conditions to obtain proper purity, focus and gray scale				X	X	X	X	X	X	X	X	X
ET-86	Identifying terms and definitions used to describe the components and operational characteristics of video amplifiers				X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

		POSSIBLE EXIT POINTS											
		DOT DESCRIPTIONS	Wirer (Computer)	Electronics Assembler	Electronics Utility Worker	Electronics Tester II	Production Repairer	Assembly Technician (Computer)	Radiotelephone Operator	Electronics Tester I	Electronics Mechanic	Radio Electrician	Radio Mechanic	Electronics Technician
TASK NO.	TASK NAME	DOT NO.	729.281-018	726.684-018	726.361-010	726.684-026	726.381-014	633.261-010	193.262-034	726.281-014	828.281-010	823.281-014	823.261-018	003.161-014
ET-87	Troubleshooting defective video amplifiers					X	X	X	X	X	X	X	X	X
ET-88	Identifying terms and definitions used to describe the components and operational characteristics of video IF amplifiers					X	X	X	X	X	X	X	X	X
ET-89	Performing condition testing and aligning to specifications RF and IF amplifiers					X	X	X	X	X	X	X	X	X
ET-90	Identifying terms and definitions used to describe the components and operational characteristics of sound IF and AM circuits					X	X	X	X	X	X	X	X	X
ET-91	Performing condition testing and aligning to specifications the sound IF and AM circuits					X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer)	Electronics Assembler	Electronics Utility Worker	Electronics Tester II	Production Repairer	Assembly Technician (Computer)	Radiotelephone Operator	Electronics Tester I	Electronics Mechanic	Radio Electrician	Radio Mechanic	Electronics Technician
	DOT NO.	729.281-018	726.684-018	726.361-010	726.684-026	726.381-014	633.261-010	193.262-034	726.281-014	828.281-010	823.281-014	823.261-018	003.161-014
ET-92	Identifying terms and definitions used to describe the components and operational characteristics of VHF and UHF tuner circuits				X	X	X	X	X	X	X	X	X
ET-93	Identifying terms and definitions used to describe the components and operational characteristics of automatic and fine tuning (AFT) and remote control circuits				X	X	X	X	X	X	X	X	X
ET-94	Identifying terms and definitions used to describe the components and operational characteristics of automobile gain control (AGC) and noise cancelling circuits				X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer) 729.281-018	Electronics Assembler 726.684-018	Electronics Utility Worker 726.361-010	Electronics Tester II 726.684-026	Production Repairer 726.381-014	Assembly Technician (Computer) 633.261-010	Radiotelephone Operator 193.262-034	Electronics Tester I 726.281-014	Electronics Mechanic 828.281-010	Radio Electrician 823.281-014	Radio Mechanic 823.261-018	Electronics Technician 003.161-014
ET-95	Identifying terms and definitions used to describe the components and operational characteristics of color television signal development, transmission, reception and decoding				X	X	X	X	X	X	X	X	X
ET-96	Performing a condition test of a picture tube and its associated circuits				X	X	X	X	X	X	X	X	X
ET-97	Identifying terms and definitions used to describe components and operational characteristics of band-pass amplifiers and circuits				X	X	X	X	X	X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer) 729.281-018	Electronics Assembler 726.684-018	Electronics Utility Worker 726.361-010	Electronics Tester II 726.684-026	Production Repairer 726.381-014	Assembly Technician (Computer) 633.261-010	Radiotelephone Operator 193.262-034	Electronics Tester I 726.281-014	Electronics Mechanic 828.281-010	Radio Electrician 823.281-014	Radio Mechanic 823.261-018	Electronics Technician 003.161-014
ET-98	Identifying terms and definitions used to describe the components and operational characteristics of color sync circuits				X	X	X	X	X	X	X	X	X
ET-99	Identifying terms and definitions used to describe the components and operational characteristics of color demodulator and output amplifier circuits				X	X	X	X	X	X	X	X	X
ET-100	Troubleshooting defective color tuning circuits				X	X	X	X	X	X	X	X	X
ET-101	Performing condition testing and aligning to specifications color convergence circuits				X	X	X	X	X	X	X	X	X
ET-102	Performing condition test and calibration of volt-ohm-milliammeter (VOM)								X	X			X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer)	Electronics Assembler	Electronics Utility Worker	Electronics Tester II	Production Repairer	Assembly Technician (Computer)	Radiotelephone Operator	Electronics Tester I	Electronics Mechanic	Radio Electrician	Radio Mechanic	Electronics Technician
DOT NO.		729.281-018	726.684-018	726.361-010	726.684-026	726.381-014	633.261-010	193.262-034	726.281-014	828.281-010	823.281-014	823.261-018	003.161-014
ET-103	Performing condition test and calibration of electronic voltmeters (EVM)								X	X			X
ET-104	Performing condition test and calibration of tube testers								X	X			X
ET-105	Performing condition test and calibration of transistor testers								X	X			X
ET-106	Performing condition test and calibration of resistor substitution box								X	X			X
ET-107	Performing condition test and calibration of oscilloscopes								X	X			X
ET-108	Performing condition test and calibration of sine wave generators								X	X			X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer) 729.281-018	Electronics Assembler 726.684-018	Electronics Utility Worker 726.361-010	Electronics Tester II 726.684-026	Production Repairer 726.381-014	Assembly Technician (Computer) 633.261-010	Radiotelephone Operator 193.262-034	Electronics Tester I 726.281-014	Electronics Mechanic 828.281-010	Radio Electrician 823.281-014	Radio Mechanic 823.261-018	Electronics Technician 003.161-014
ET-109	Performing condition test and calibration of square wave and pulse generators								X	X			X
ET-110	Performing condition test and calibration of frequency meters								X	X			X
Duty D:	Maintenance of Electronic Equipment												
ET-111	Performing visual inspection of electronic equipment	X	X			X	X	X		X	X	X	X
ET-112	Cleaning electronic equipment	X	X			X	X	X		X	X	X	X
ET-113	Lubricating electronic equipment	X	X			X	X	X		X	X	X	X
ET-114	Inspecting and replacing cords and cables	X	X			X	X	X		X	X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer) 729.281-018	Electronics Assembler 726.684-018	Electronics Utility Worker 726.361-010	Electronics Tester II 726.684-026	Production Repairer 726.381-014	Assembly Technician (Computer) 633.261-010	Radiotelephone Operator 193.262-034	Electronics Tester I 726.281-014	Electronics Mechanic 828.281-010	Radio Electrician 823.281-014	Radio Mechanic 823.261-018	Electronics Technician 003.161-014
		DOT DESCRIPTIONS / DOT NO.											
ET-115	Inspecting and replacing tubes	X	X			X	X	X		X	X	X	X
ET-116	Inspecting and replacing transistors	X	X			X	X	X		X	X	X	X
ET-117	Inspecting and replacing IC units	X	X			X	X	X		X	X	X	X
ET-118	Inspecting and replacing PC boards	X	X			X	X	X		X	X	X	X
ET-119	Inspecting and repairing loudspeakers	X	X			X	X	X		X	X	X	X
ET-120	Inspecting and repairing microphones	X	X			X	X	X		X	X	X	X
ET-121	Performing a proof of performance on electronic equipment										X	X	X
ET-122	Keeping records on maintenance of equipment										X	X	X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer) 729.281-018	Electronics Assembler 726.684-018	Electronics Utility Worker 726.361-010	Electronics Tester II 726.684-026	Production Repairer 726.381-014	Assembly Technician (Computer) 633.261-010	Radiotelephone Operator 193.262-034	Electronics Tester I 726.281-014	Electronics Mechanic 828.281-010	Radio Electrician 823.281-014	Radio Mechanic 823.261-018	Electronics Technician 003.161-014
Duty E:	Assembling and Modifying Electronic Circuitry												
ET-123	Constructing PC boards												X
ET-124	Designing voltage amplifiers												X
ET-125	Designing wave shaping circuits												X
ET-126	Designing logic circuits												X
ET-127	Drawing electrical one-line diagrams from engineering												
	sketches												X
ET-128	Drawing electrical elementary diagrams from engineering												
	sketches												X

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TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

TASK NO.	TASK NAME	POSSIBLE EXIT POINTS											
	DOT DESCRIPTIONS	Wirer (Computer)	Electronics Assembler	Electronics Utility Worker	Electronics Tester II	Production Repairer	Assembly Technician (Computer)	Radiotelephone Operator	Electronics Tester I	Electronics Mechanic	Radio Electrician	Radio Mechanic	Electronics Technician
	DOT NO.	729.281-018	726.684-018	726.361-010	726.684-026	726.381-014	633.261-010	193.262-034	726.281-014	828.281-010	823.281-014	823.261-018	003.161-014
ET-129	Drawing electronic schematic diagrams from engineering sketches												X
ET-130	Laying out, taping up and drawing basic printed circuit boards												X
ET-131	Modifying schematics												X
ET-132	Modifying circuits to accommodate IC's												X
ET-133	Preparing assembly guides												X
ET-134	Preparing parts lists												X
ET-135	Preparing preliminary sketches												X
ET-136	Drawing logic symbols												X
ET-137	Making truth tables for logic gates												X

TASK LISTING BY DOT CODE

ELECTRONIC TECHNOLOGY

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Wirer (Computer)	Electronics Assembler	Electronics Utility Worker	Electronics Tester II	Production Repairer	Assembly Technician (Computer)	Radiotelephone Operator	Electronics Tester I	Electronics Mechanic	Radio Electrician	Radio Mechanic	Electronics Technician
	DOT NO.	729.281-018	726.684-018	726.361-010	726.684-026	726.381-014	633.261-010	193.262-034	726.281-014	828.281-010	823.281-014	823.261-018	003.161-014
ET-138	Determining meter movement, sensitivity and resistance												X
ET-139	Extending the current range of a meter movement												X
ET-140	Extending the voltage range of a meter movement												X

SECTION IV

CURRICULUM STRUCTURE & COURSE OUTLINE

CURRICULUM STRUCTURE

The following examples of curriculum structures are provided to illustrate the different ways an electronics technology Program can be structured. The examples are not intended to imply there are not other ways to structure the curriculum.

Alternative I follows the duties and tasks described in this guide. Alternatives II and III are examples of local programs operating within Georgia. The time on tasks estimates of each alternative vary according to local program objectives. The actual amount of time required for each course will depend upon the instructor, the students and facilities available.

Each instructor is encouraged to structure the curriculum and make time estimates based on experience, industry requirements, students' needs and the local facilities (plant, equipment and field area available).

ELECTRONICS TECHNOLOGY CURRICULUM STRUCTURE

Alternative I

Course Number	Course	Clock Hours
	First Quarter	
	Tools, Safety and Equipment	156
	Measurement and Calculating DC	104
	Mathematics I, Algebra	52
		312
	Second Quarter	
	Measurement and Calculating AC	208
	Testing Sub-Assemblies, Part I	104
		312
	Third Quarter	
	Testing Sub-Assemblies, Part II	208
	Mathematics II, Trigonometry	52
	Communication Skills, Composition	52
		312
	Fourth Quarter	
	Testing Sub-Assemblies, Part III	208
	Maintenance of Equipment, Part I	52
	Laboratory, Industrial Electronics	52
		312
	Fifth Quarter	
	Testing Sub-Assemblies, Part IV	104
	Maintenance of Equipment, Part II	52
	Mathematics III, Boolean Algebra	52
	Laboratory, Operation of Radio-Telephone Equipment	52

Course Number	Course	Clock Hours
	Laboratory, Radio-Telephone Equipment Maintenance	52
		312
	Sixth Quarter	
	Maintenance of Equipment, Part III	52
	Designing Electronic Circuitry	156
	Communication Skills, Report Writing	52
	Laboratory, Antenna Construction and Maintenance	52
		312
	Seventh Quarter	
	Maintenance of Equipment, Part IV	52
	Designing Electronic Circuitry, Part II	156
	Laboratory, Radio Maintenance	52
	Laboratory, Computer Systems	52
		312
	Eighth Quarter	
	Designing Electronic Circuitry, Part III	156
	Laboratory, Microwave Systems	52
	Laboratory, Pulse and Switching Circuits	52
	Laboratory, FCC License Preparation	52
		312

CURRICULUM STRUCTURE

Alternative II*

Course Number	Course	Hours
	First Quarter	
	Introduction to Electronics	52
	Basic Electricity for Electronics	104
	DC Circuits for Electronics	104
	Algebra for Electronics	52
		312
	Second Quarter	
	Introduction to AC Electronics	52
	AC Circuits and Transformers	104
	Resonance and Filters	104
	Electronics Trigonometry	52
		312
	Third Quarter	
	Electronic Fundamentals	104
	Electronic Amplifiers & Oscillators	104
	Digital Electronics Fundamentals	52
	Consumer Education	26
	Human Relations	26
		312
	Fourth Quarter	
	Electronic Communications Theory	104
	Electronic Communications Lab	52
	FCC License Preparation, 2nd Class	104
	Boolean Algebra	52
		312

Course Number	Course	Hours
	Fifth Quarter	
	Antenna Fundamentals	52
	Semiconductor Technology & IC's	104
	Digital Logic Circuits	104
	FCC License Preparation, 1st Class	52
		312
	Sixth Quarter	
	Basic Computer Programming (Electronics)	104
	Microwave Principles	104
	Audio Measurements & Acoustics	104
		312
	Seventh Quarter	
	Industrial Electronics	104
	Pulse & Switching Circuits	104
	Digital Computer Fundamentals	104
		312
	Eighth Quarter	
	Electronic Instrumentation	104
	Computer Circuits (Electronics)	104
	Microcomputers	104
	or	
	** Electronics Work Study in Field	312
	TOTAL HOURS	2496

* Supplied by: Atlanta Area Technical School

** Work Study alternative must be selected and approved by Department Chairperson prior to entering 8th Quarter.

ELECTRONIC TECHNOLOGY CURRICULUM STRUCTURE

Alternative III*

Course Number	Course	Hours
	First Quarter	
	DC Circuit Analysis	104
	Application of DC Circuit Analysis	104
	Communication Skills	52
	Technical Math I	52
		312
	Second Quarter	
	AC Circuit Analysis	156
	Application of AC Circuit Analysis	104
	Technical Math II	52
		312
	Third Quarter	
	Active Devices	104
	Application of Active Devices	104
	Technical Math III	52
	Electronic Drafting	52
		312
	Fourth Quarter	
	Basic Linear Circuits and System	156
	Application of Basic Linear Circuits and Systems	104
	Consumer Education	52
		312
	Fifth Quarter	
	Advanced Linear Circuits and Systems	156
	Application of Advanced Linear Circuits and Systems	104

Course Number	Course	Hours
	Technical English	52
		312
	Sixth Quarter	
	Digital Integrated Circuits	156
	Application of Digital Integrated Circuits	104
	Human Relations	52
		312
	Seventh Quarter	
	Linear Integrated Circuits	104
	Application of Linear Integrated Circuits	104
	Electronic Project	104
		312
	TOTAL	2,184

* Supplied by: Augusta Area Technical School

COURSE OUTLINE

In this section, a suggested course outline for the quarter format is presented. While the listing of tasks within each competency represents a difficulty scale moving from least to most, it does not indicate a required sequence nor implies that each is a necessary prerequisite to that which succeeds it. The sequence of unit guide presentation may be adapted to match student group(s), facilities, equipment and available time to the specific learning objective. The detailed information required to teach each competency is listed in the corresponding "task" numbered unit guide sheet in Section V of this curriculum guide.

The time estimates (hours) for completion of unit activities are expressed in minimums. Across the eight-quarter time frame, these estimates account for 70% of the available clock hours devoted to program structure. The remaining hours provide the flexibility needed to adapt related instruction needs, schedule laboratory projects as are appropriate to the identified occupation(s) and introduce course work from other disciplines which will provide "supportive" skills development needed to integrate the electronic technology worker into the world of work.

SUGGESTED COURSE OUTLINE STRUCTURE
FOR ELECTRONICS TECHNOLOGY

Quarter I

Unit	Title	Hours
	Course Title: Tools, Safety and Equipment	
ET-01	Observing electrical safety precautions	6
ET-02	Identifying and using hand tools	6
ET-03	Identifying and using sheet metal tools	12
ET-04	Identifying and using power tools	12
ET-05	Identifying and using volt-ohm milliammeters (VOM)	6
ET-06	Identifying and using electronic-volt meters (EVM)	6
ET-07	Identifying and using ohmmeters	6
ET-08	Identifying and using oscilloscopes	12
ET-09	Identifying and using tube testers	6
ET-10	Identifying and using transistor analyzers	6
ET-11	Identifying and using capacitor testers	6
ET-12	Identifying and using sine wave generators	12
ET-13	Identifying and using signal generators	12
ET-14	Identifying and using pulse generators	12
ET-15	Identifying and using square wave generators	12
ET-16	Identifying and using impedance testers	12
ET-17	Identifying and using frequency meters	12
		156
	Course Title: Measurement and Calculation: DC	
ET-18	Understanding fundamentals of electrical theory and electrical measurement	12
ET-19	Making calculations using Ohm's law	6
ET-20	Measuring current in DC circuits	6
ET-21	Measuring voltage in DC circuits	6
ET-22	Calculating and measuring resistance in DC circuits	12
ET-23	Calculating voltage, current and resistance in DC series circuits	12
ET-24	Calculating total voltage, total current and total resistance in DC parallel circuits	12
ET-25	Calculating and measuring electrical quantities in combination DC circuits	12
ET-26	Calculating power in DC circuits	6
ET-27	Applying fundamentals of magnetism and electromagnetism	6
ET-28	Using test instruments to measure voltage, current and resistance	10
ET-29	Calculating values in DC network circuits	4
		104

Related Instruction

Technical Mathematics I, Algebra	52
Quarter I Hours	312

Quarter II

Unit	Title	Hours
	Course Title: Measurement and Calculation: AC	
ET-30	Calculating capacitance and time constants for RC circuits	10
ET-31	Calculating values for a right triangle	6
ET-32	Identifying the characteristics of AC sine waves	6
ET-33	Measuring AC values for LF circuits	6
ET-34	Determining reactance and impedance of a capacitor in either series or parallel circuits	6
ET-35	Calculating and measuring electrical values in AC capacitance circuits	12
ET-36	Measuring inductance in series RL circuits	12
ET-37	Computing turns, voltage, current and impedance ratios of transformers	12
ET-38	Drawing phasor diagrams and calculating operating values for series AC circuits	12
ET-39	Drawing phasor diagrams and calculating operating values for parallel AC circuits	12
ET-40	Understanding fundamentals of tuned AC circuits	6
ET-41	Understanding fundamentals of semi-conductor materials	12
ET-42	Performing a condition test of a semi-conductor diode using an ohmmeter	6
ET-43	Performing a condition test of zener diodes used in regulator circuits	12
ET-44	Identifying symbols and electrical characteristics of tunnel, varactor and high frequency diodes	12
ET-45	Understanding the fundamentals of bipolar transistors and their electrical characteristics	6
ET-46	Performing condition tests of bipolar transistors	12
ET-47	Understanding the fundamentals of field effect transistors and their electrical characteristics	6
ET-48	Understanding the fundamentals of thyristors and their electrical characteristics	6
ET-49	Understanding fundamentals of integrated circuits	6
ET-50	Defining the operating values and applications of optoelectronic devices	6
ET-51	Identifying the component parts and operational characteristics of diode vacuum tubes	6
ET-52	Identifying the component parts and operating characteristics of triode vacuum tubes	6
ET-53	Identifying the component parts and operating characteristics of tetrode vacuum tubes	6
ET-54	Identifying the component parts and operating characteristics of pentode vaccum tubes	6
		208
	Course Title: Testing Sub-Assemblies, Part I	
ET-55	Performing condition testing of the thermal stability and operational parameters of a common-emitter amplifier circuit	12

Unit	Title	Hours
ET-56	Performing condition testing of DC and audio amplifiers	12
ET-57	Defining electrical characteristics, applications and normal operational values of amplifiers	6
ET-58	Testing an amplifier for amplification	6
ET-59	Testing and repairing a vacuum tube amplifier	6
ET-60	Testing and repairing a transistor amplifier	12
ET-61	Identifying component parts and electrical characteristics of power supply circuits	8
ET-62	Testing and repairing power supplies	6
ET-63	Calibrating power supply voltage	6
ET-64	Constructing and performing a condition test of oscillators	12
ET-65	Testing and repairing oscillators	12
ET-66	Testing and repairing clampers	6
		104
	Quarter II Hours	312

Quarter III

Course Title: Testing Sub-Assemblies, Part II

Unit	Title	Hours
ET-67	Testing and repairing clipper circuits	6
ET-68	Testing and repairing counters	12
ET-69	Constructing and performing condition tests of pulse circuits	12
ET-70	Testing and repairing nonsinusoidal wave shape amplifiers	12
ET-71	Identifying electrical characteristics and operating values of amplitude modulators (AM) and AM detectors	12
ET-72	Identifying electrical characteristics and operating values of frequency modulators (FM) and FM detectors	12
ET-73	Constructing and performing condition testing of superheterodyne receivers	18
ET-74	Identifying sequence and electrical characteristics of television signal development, transmission, reception and decoding	12
ET-75	Identifying the components and electrical characteristics of a low voltage power supply and its protective circuit	12
ET-76	Performing condition testing on a low voltage power supply	12
ET-77	Troubleshooting a defective switch-mode secondary voltage supply	12
ET-78	Troubleshooting defective synchronizing and deflection circuits	12
ET-79	Troubleshooting defective horizontal output circuits	12
ET-80	Troubleshooting sweep generator circuits	12
ET-81	Troubleshooting a defective high voltage supply	12
ET-82	Troubleshooting electrical circuits	12
ET-83	Performing physical and electrical alignment of the picture tube and its associated circuits	12
ET-84	Troubleshooting a defective vertical deflection circuit	16
		208

Related Instruction

	Technical Mathematics II, Trigonometry	52
	Communications Skills, English Composition	52
	Quarter III Hours	312

Quarter IV

Unit	Title	Hours
	Course Title: Testing Sub-Assemblies, Part III	
ET-85	Adjusting circuit operational conditions to obtain proper purity, focus and gray scale	8
ET-86	Identifying terms and definitions used to describe the components and operational characteristics of video amplifiers	14
ET-87	Troubleshooting defective video amplifiers	12
ET-88	Identifying terms and definitions used to describe the components and operational characteristics of video IF amplifiers	12
ET-89	Performing condition testing and aligning to specifications RF and IF amplifiers	12
ET-90	Identifying terms and definitions used to describe the components and operational characteristics of sound IF and AM circuits	12
ET-91	Performing condition testing and aligning to specifications the sound IF and AM circuits	12
ET-92	Identifying terms and definitions used to describe the components and operational characteristics of VHF and UHF tuner circuits	12
ET-93	Identifying terms and definitions used to describe the components and operational characteristics of automatic and fine tuning (AFT) and remote control circuits	12
ET-94	Identifying terms and definitions used to describe the components and operational characteristics of automatic gain control (AGC) and noise cancelling circuits	12
ET-95	Identifying terms and definitions used to describe the components and operational characteristics of color television signal development, transmission, reception and decoding	12
ET-96	Performing a condition test of a picture tube and its associated circuits	12
ET-97	Identifying terms and definitions used to describe components and operational characteristics of band-pass amplifiers and circuits	12
ET-98	Identifying terms and definitions used to describe the components and operational characteristics of color sync circuits	12
ET-99	Identifying terms and definitions used to describe the components and operational characteristics of color demodulator and output amplifier circuits	12
ET-100	Troubleshooting defective color tuning circuits	18
ET-101	Performing condition testing and aligning to specifications color convergence circuits	12
		208

Unit	Title	Hours
	Course Title: Maintenance of Equipment, Part I	
ET-111	Performing visual inspection of electronic equipment	10
ET-112	Cleaning electronic equipment	12
ET-113	Lubricating electronic equipment	18
ET-114	Inspecting and replacing cords and cables	12
		52
	Related Instruction:	
	Laboratory, Industrial Electronics	52
	Quarter IV Hours	312

Quarter V

Unit	Title	Hours
	Course Title: Testing Sub-Assemblies, Part II	
ET-102	Performing condition test and calibration of volt-ohm-milliammeter (VOM)	12
ET-103	Performing condition test and calibration of electronic voltmeters (EVM)	12
ET-104	Performing condition test and calibration of tube testers	12
ET-105	Performing condition test and calibration of transistor testers	12
ET-106	Performing condition test and calibration of resistor substitution box	6
ET-107	Performing condition test and calibration of oscilloscopes	14
ET-108	Performing condition test and calibration of sine wave generators	12
ET-109	Performing condition test and calibration of square wave and pulse generators	12
ET-110	Performing condition test and calibration of frequency meters	12
		104
	Course Title: Maintenance of Equipment, Part II	
ET-115	Inspecting and replacing tubes	10
ET-116	Inspecting and replacing transistors	18
ET-117	Inspecting and replacing IC units	24
		52
	Related Instruction:	
	Technical Mathematics III, Boolean Algebra	52
	Laboratory, Operation of Radio-Telephone Equipment	52
	Laboratory, Maintenance of Radio-Telephone Equipment	52
	Quarter V Hours	312

Quarter VI

Unit	Title	Hours
	Course Title: Maintenance of Equipment, Part III	
ET-118	Inspecting and replacing PC boards	24
ET-119	Inspecting and repairing loudspeakers	18
ET-120	Inspecting and repairing microphones	10
		52
	Course Title: Designing Electronic Circuitry, Part I	
ET-123	Constructing PC boards	30
ET-124	Designing voltage amplifiers	24
ET-125	Designing wave shaping circuits	24
ET-126	Designing logic circuits	30
ET-127	Drawing electrical one-line diagrams from engineering sketches	24
ET-128	Drawing electrical elementary diagrams from engineering sketches	24
		156
	Related Instruction:	
	Communications Skills II, Technical Report Writing	52
	Laboratory, Antenna Construction and Maintenance	52
	Quarter VI Hours	312

Quarter VII

Unit	Title	Hours
	Course Title: Maintenance of Equipment, Part IV	
ET-121	Performing a proof of performance on electronic equipment	28
ET-122	Keeping records on maintenance of equipment	24
		52
	Course Title: Designing Electronic Circuitry, Part II	
ET-129	Drawing electronic schematic diagrams from engineering sketches	24
ET-130	Laying out, taping up and drawing basic printed circuit boards	30
ET-131	Modifying schematics	24
ET-132	Modifying circuits to accommodate IC's	24
ET-133	Preparing assembly guides	24
ET-134	Preparing parts lists	30
		156
	Related Instruction:	
	Laboratory, Radio Maintenance	52
	Laboratory, Computer Systems	52
	Quarter VII Hours	312

Quarter VIII

Unit	Title	Hours
	Course Title: Designing Electronic Circuitry, Part III	
ET-135	Preparing preliminary sketches	24
ET-136	Drawing logic symbols	30
ET-137	Making truth tables for logic gates	30
ET-138	Determining meter movement, sensitivity and resistance	24
ET-139	Extending the current range of a meter movement	24
ET-140	Extending the voltage range of a meter movement	24
		156
	Related Instruction:	
	Laboratory, Microwave systems	52
	Laboratory, Pulse and Switching Circuits	52
	Laboratory, FCC License Preparation	52
	Quarter VIII Hours	312

SECTION V

UNIT GUIDES

UNIT GUIDES

Description

In this section the tasks to be taught in each course are presented in sequential order. Each task is listed on a separate page so that it may be taken out of the guide for daily lesson planning or regrouped with other tasks to fit the individual teacher's own preference for teaching order. The task pages may be used for planning and executing group instruction or for individualized instruction. Each page in the UNIT GUIDES section contains the following information:

TASK: This is a short and concise statement of the task to be taught.

PERFORMANCE OBJECTIVE: The performance expected of the student after completing the unit is stated in stem from, without a specific statement of all conditions, equipment and performance standards (these are listed in a criterion referenced measure in the Evaluation section of the task page).

INSTRUCTIONAL ACTIVITIES: Suggested learning activities are presented. These activities include providing information, demonstration, use of audio visuals and practical applications.

INSTRUCTIONAL MATERIALS: The materials that are necessary to carry out the instructional activities are listed. These include textbooks, audio visuals and equipment.

EVALUATION: This section contains a criterion referenced measure (where appropriate) and reference to any test items or other evaluation measures that are available to the teacher. The criterion referenced measure contains three parts--Condition, Performance and Standard.

CLASSROOM HOURS: The estimated time for completion of the instructional activities and the evaluation are indicated. This time estimate is stated in hours of classroom time related to each task.

UNIT GUIDES

Description

In this section the tasks to be taught in each course are presented in sequential order. Each task is listed on a separate page so that it may be taken out of the guide for daily lesson planning or regrouped with other tasks to fit the individual teacher's own preference for teaching order. The task pages may be used for planning and executing group instruction or for individualized instruction. Each page in the UNIT GUIDES section contains the following information:

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INSTRUCTIONAL MATERIALS: The materials that are necessary to carry out the instructional activities are listed. These include textbooks, audio visuals and equipment.

EVALUATION: This section contains a criterion referenced measure (where appropriate) and reference to any test items or other evaluation measures that are available to the teacher. The criterion referenced measure contains three parts--Condition, Performance and Standard.

CLASSROOM HOURS: The estimated time for completion of the instructional activities and the evaluation are indicated. This time estimate is stated in hours of classroom time related to each task.

TASK

ET-01 Observing electrical safety precautions

PERFORMANCE OBJECTIVE

Observe all precautions for electrical safety.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Basic electricity
    1. Amperes
    2. Volts
    3. Ohm
    4. Ohm's law
    5. Short circuit
b. Electrical injuries
c. Preventing electrical accidents
d. Overcurrent protection
    1. Fuses
    2. Circuit breakers
e. Grounding
    1. Ground faults
    2. GFC
f. Hazardous location
g. Double insulated tools
h. General electrical safety rules

Provide Demonstration On:

Procedure for treating shock

Provide Practical Application On:

Develop a safety checklist.

INSTRUCTIONAL MATERIALS

A/Vs:

a. Career Aids, Inc., filmstrip #LX60, "Electrical Safety in the Shop"
b. Career Aids, Inc., filmstrip #TX3-1F1, "Electricity/Electronics"

Student Manuals:

a. Heathkit, DC Electronics, Student Workbook
b. Georgia, Electronics Technology, Phase A, Unit 3-A
c. MAVCC, Basic Electronics 1

CLASSROOM HOURS 6

EVALUATION (ET-01)

a. Given electrical safety rules for the shop, the student will identify and describe electrical safety procedures and devices according to the instructor's specifications.

b. Heathkit, DC Electronics, Student Workbook.

c. MAVCC, Basic Electronics 1.

d. Georgia, Electronics Technology, Phase A, Student Tests.

TASK

ET-02 Identifying and using hand tools

PERFORMANCE OBJECTIVE

Identify and use hand tools.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Screwdrivers
    1. Flat blade
    2. Phillips
    3. Socket head
    4. Offset
b. Parts of a screwdriver
    1. Blade
    2. Handle
    3. Shank
c. Safety
    1. Match blade to screw head
    2. Keep blade ends ground flat and square
    3. Handles free of oil, grease
    4. Do not use as punch or or chisel.
    5. Do not use pliers or wrenches to get more leverage.
    6. Always use the screwdriver with the blade from the body.
d. Hammers
    1. Carpenter's hammer (claw)
    2. Machinist hammer (ball peen)
    3. Soft face hammers
e. Hammer safety
    1. Keep the hammer free of oil or grease.
    2. Never leave a hammer on a ladder.

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

Dover Publications, Inc., Tools and Their Uses

A/Vs:

a. Hobar, "Hammer, Nails and Nailing Techniques" and "Screws and Driving Tools"
b. DCA, "Hand Tools, Series One"

Student Manuals:

Plant Engineering Training Systems, Elements of Mechanics

Tools and Equipment:

a. Screwdrivers
b. Hammers
c. Chisels
d. Hacksaws
e. Wrenches

(Continued on back)

CLASSROOM HOURS

6

EVALUATION (ET-02)

Given a job, the student will identify the correct tools for the job and use the tools in the appropriate manner. The completed job must be in compliance with industry requirements.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

f. Wrenches
    1. Adjustable end wrench
    2. Pipe wrench
    3. Open end wrench
    4. Box end wrench
    5. Combination wrenches
    6. Socket wrenches, ratchet handle and speed handle
    7. Torque wrench
    8. Safety

g. Pliers
    1. Slip-joint pliers
    2. Water-pump pliers
    3. Grooved or arc joint pliers
    4. Locking pliers
    5. Safety

h. Hacksaws

i. Punches and chisels
    1. Center punch
    2. Aligning punch
    3. Drift punch
    4. Gasket punch

j. Drills

k. Files

l. Tin snips

m. Taps and dies
    1. Taper
    2. Plug
    3. Bottoming
    4. T-handle
    5. Straight handle

INSTRUCTIONAL MATERIALS

Tools and Equipment:

f. Pliers

g. Drills

h. Taps and dies

TASK

ET-03 Identifying and using sheet metal tools

PERFORMANCE OBJECTIVE

Identify and use sheet metal tools.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of sheet metal
b. Sheet metal gages
c. Sheet metal layout
d. Dividers
e. Punches
f. Rivet set
g. Metal cutting chisels
h. Hammer
i. Metal cutting snips
j. Aviation pattern snips
k. Dressing a cut metal sheet
l. Sheet metal notchers
m. Sheet metal punching tools
n. Bench stakes
o. Sheet metal forming tools
p. Hand seamers
q. Soldering
r. Sheet metal safety

Provide Practical Application On:

Identify metal working tools in the tool room and describe/demonstrate the use of the tools.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ludwig and McCarthy, Metal Work Technology and Practice
b. Walker, Modern Metalworking

A/Vs:

a. Hobar, "Sheet Metal Hand Tools"
b. Bergwall, "Sheet Metal Work"

Student Manuals:

a. Plant Engineering Training Systems, Hand Tools, Lesson Eight
b. California State Department of Education, Sheet Metal Tools and Equipment Workbook

Tools and Equipment:

Collection of metal working tools

CLASSROOM HOURS

12

EVALUATION (ET-03)

Given a selection of metal working tools, the student will identify the tool and demonstrate its proper use. The following tools will be identified:

1. Sheet metal gages
2. Punches
3. Chisels
4. Rivet sets
5. Hammers
6. Tin snips
7. Forming tools
8. Soldering tools

TASK

ET-04 Identifying and using power tools

PERFORMANCE OBJECTIVE

Identify and use power tools.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safe use of portable power tools
    1. Personal safety
    2. Electrical safety
b. Hand drill
    1. Chuck
    2. Drill safety
c. Drill press
    1. Safety
    2. Drill bit selection
    3. Work holding devices
    4. Center drilling
d. Bench grinders
    1. Safety
    2. Dressing the wheel
    3. Types of work

INSTRUCTIONAL MATERIALS

Textbooks:

Dover Publications, Inc., Tools and Their Uses

A/Vs:

Hobar, "Using Portable Power Tools", "Drill Press Parts and Controls" and "Tool Grinder"

Student Manuals:

Plant Engineering Training Systems, Elements of Mechanics, Lesson Eight

Tools and Equipment:

a. Drills
b. Drill press
c. Bench grinder

CLASSROOM HOURS 12

EVALUATION (ET-04)

Given a selection of power tools, the student will accurately identify each tool, describe its use and identify safety rules for operation of the tool. The following tools will be used:

1. Drills
2. Drill press
3. Bench grinder

TASK

ET-05 Identifying and using volt-ohm milliammeters (VOM)

PERFORMANCE OBJECTIVE

Identify the operating controls of the VOM, correctly set-up the controls for voltage, current and resistance measurements, and read the meter scale.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. VOM safety
b. VOM control settings
c. VOM scale interpretation

Provide Demonstration On:

a. Safe use of a VOM
b. How to correctly connect and read the VOM in measuring voltage, current and resistance

Provide Practical Application On:

a. Identifying VOM safety rules
b. Setting VOM controls for voltage, current and resistance measurements
c. Measuring and reading assigned voltage, current and resistance

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Gilli, Electrical Principles for Electronics

A/Vs:

Georgia, Electronics Technology, Phase A, "Use and Care of the VOM and VTVM", slide/tape 14-A

Student Manuals:

a. Heathkit, DC Electronics, Student Workbook
b. Georgia, Electronics Technology, Phase A, Unit 14
c. MAVCC, Basic Electronics 1

Tools and Equipment:

a. VOM
b. Circuit to provide voltage, current and resistance measurements

CLASSROOM HOURS

6

EVALUATION (ET-05)

a. Given a VOM and an assigned circuit, the student will correctly set and connect the VOM to the circuit and make accurate measurements of current and resistance voltage.

b. Heathkit, DC Electronics, Student Workbook.

c. MAVCC, Basic Electronics 1.

d. Georgia, Electronics Technology, Phase A, Student Tests.

TASK

ET-06 Identifying and using electronic voltmeters (EVM)

PERFORMANCE OBJECTIVE

Identify the operating controls on the EVM and set up the controls for voltage current and resistance.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. EVM safety
b. EVM control functions
c. EVM interpretation

Provide Demonstration On:

a. EVM safety
b. Connecting and reading an EVM to measure current and resistance voltage

Provide Practical Application On:

a. List EVM safety rules/procedures.
b. Set up and read current and resistance voltage using the EVM.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Gilli, Electrical Principles for Electronics

A/Vs:

Georgia, Electronics Technology, Phase A, "Use and Care of the VOM and VTVM", slide/tape 14-A

Tools and Equipment:

a. EVM
b. Circuit to provide voltage, current and resistance measurements

CLASSROOM HOURS 6

EVALUATION (ET-06)

a. Given an EVM and an assigned circuit, the student will correctly set up the controls and accurately measure current and resistance voltage.

b. Heathkit, DC Electronics, Student Workbook.

c. MAVCC, Basic Electronics 1.

d. Georgia, Electronics Technology, Phase A, Student Tests.

TASK

ET-07 Identifying and using ohmmeters

PERFORMANCE OBJECTIVE

Identify and be able to set up the controls of a standard ohmmeter.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Ohmmeter safety
b. Ohmmeter control setting
c. Ohmmeter scale reading
d. Color code
e. Resistance tolerance

Provide Demonstration On:

a. Ohmmeter safety
b. Connecting and reading the ohmmeter
c. Calculating resistance tolerance limits for good/bad

Provide Practical Application On:

a. List/demonstrate ohmmeter safety.
b. Set up ohmmeter and connect to resistors.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Gilli, Electrical Principles for Electronics

A/Vs:

Georgia, Electronics Technology, Phase A, "Resistor Color Code and Use of the Ohmmeter", slide/tape 8-A

Student Manuals:

a. Heathkit, DC Electronics, Student Workbook
b. Georgia, Electronics Technology, Phase A, Unit 8-A
c. MAVCC, Basic Electronics 1

Tools and Equipment:

a. ET-3100 Electronic Design Experimeter or equivalent
b. Voltmeter with test leads
c. Resistors (good and bad)

CLASSROOM HOURS

6

EVALUATION (ET-07)

a. Given an ohmmeter and resistors of unknown value, the student will determine the value of each resistor. Readings must be within instructor's specifications.

b. Heathkit, DC Electronics, Student Workbook.

c. MAVCC, Basic Electronics 1.

d. Georgia, Electronics Technology, Phase A, Student Tests.

TASK

ET-08 Identifying and using oscilloscopes

PERFORMANCE OBJECTIVE

Identify and set-up the operating controls of the oscilloscope.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. O-scope safety
b. O-scope preliminary control settings
c. O-scope hook-up to circuit
d. Scale interpretation

Provide Demonstration On:

a. How to use the scope manual to set-up vertical and horizontal controls
b. How to correctly connect and read the voltage P-P, frequency and period of an AC signal

Provide Practical Application On:

Measure voltage, current period, frequency and time interval.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Zbar, Basic Electricity
b. Gilmore, Instruments and Measurements

A/Vs:

a. Georgia, Electronics Technology, Phase A, "Function and Use of the Oscilloscope", slide/tape 28-A
b. Bergwall, "Basic Electricity and Electronics Explained-AC", Filmstrip 802-3, 802-4, 802-5

Student Manuals:

a. Heathkit, Electronic Circuits, Student Workbook
b. Georgia, Electronics Technology, Phase A, Unit 28-A
c. MAVCC, Basic Electronics 1

Tools and Equipment:

a. Oscilloscope
b. Manual for scope
c. Circuit to provide voltage, current and AC signals to be measured

CLASSROOM HOURS

12

EVALUATION (ET-08)

a. Given an oscilloscope and necessary circuits, the student will measure and record the peak to peak amplitude, period, and frequency of signals. Recordings must be within ten percent of known values.

b. Heathkit, AC Electronics, Student Workbook.

c. MAVCC, Basic Electronics 1.

d. Georgia, Electronics Technology, Phase A, Student Tests.

e. Bergwall, filmstrip study questions.

TASK

ET-09 Identifying and using tube testers

PERFORMANCE OBJECTIVE

Use the tube tester and determine condition of various tubes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Tube-tester safety
b. Preliminary control settings (how to use the set-up chart)
c. How to interpret the meter scale

Provide Demonstration On:

a. How to set-up the tube tester by the tube chart
b. How to insert the tube
c. How to test the tube
d. How to read the scale for good/bad decision

Provide Practical Application On:

Testing tubes for condition with tube tester

INSTRUCTIONAL MATERIALS

Student Manuals:

Georgia, Electronics, Phase B, Unit 13-B

Tools and Equipment:

a. Tube tester
b. Manual
c. Good and bad tubes

CLASSROOM HOURS 6

EVALUATION (ET-09)

Given a tube tester and necessary tools and equipment, the student will test a selection of tubes and record the condition. Recordings must be accurate within known values.

TASK

ET-10 Identifying and using transistor analyzers

PERFORMANCE OBJECTIVE

Use the transistor analyzer to check transistors for condition.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Transistor analyzer safety
b. Preliminary control settings (how to use the set-up chart)
c. How to hook-up the test leads
d. How to interpret the meter readings

Provide Demonstration On:

a. How to set-up the transistor analyzer controls by the analyzer chart
b. How to safely hookup the test leads
c. How to read the meter values

INSTRUCTIONAL MATERIALS

Student Manuals:

a. Georgia, Electronics Phase B, Unit 6-B
b. Heathkit, Solid State Electronics, Student Workbook

Tools and Equipment:

a. Transistor analyzer
b. Manual
c. Good and bad transistors

CLASSROOM HOURS 6

EVALUATION (ET-10)

a. Given a transistor analyzer and a selection of transistors, the student will determine the condition of the transistors to one-hundred percent accuracy.

b. Heathkit, Solid State Electronics, Student Workbook.

TASK

ET-11 Identifying and using capacitor testers

PERFORMANCE OBJECTIVE

Use the capacitor analyzer to measure leakage and capacitance.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Capacitor tester safety
b. Capacitor tester hook-up to circuit or part
c. Capacitor tester preliminary control settings
d. Scale interpretation

Provide Demonstration On:

a. How to use the capacitor tester manual to correctly preset operation controls
b. How to correctly connect and read the capacitor tester scale to determine leakage and capacitance values

Provide Practical Application On:

Have learner demonstrate the correct and safe way to set-up, connect and read the results of using a capacitor tester to check capacitor parameters.

INSTRUCTIONAL MATERIALS

Student Manuals:

a. Heathkit, DC Electronics, Student Workbook
b. Georgia, Electronics Technology, Phase A, Units 31-A and 32-A
c. MAVCC, Basic Electronics 1

Tools and Equipment:

a. Capacitor tester manual
b. Capacitor tester
c. Capacitors to be checked
d. Capacitor specification manual

CLASSROOM HOURS	6

EVALUATION (ET-11)

a. Given a capacitor tester and ten capacitors of unknown condition, the student will demonstrate to the instructor the safe way to connect, set-up, read and record the results of the measurements. The student must correctly identify the servicable and defective capacitors.

b. Heathkit, DC Electronics, Student Workbook.

c. MAVCC, Basic Electronics 1.

d. Georgia, Electronics Technology, Phase A, Student Tests.

TASK

ET-12 Identifying and using sine wave generators

PERFORMANCE OBJECTIVE

Use the sine wave generator to inject test signals into a test circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Generator safety
b. Generator control settings
c. Generator hook-up to test circuit

Provide Demonstration On:

a. How to use the sine wave generator manual to set-up the controls
b. How to correctly connect to a test circuit

Provide Practical Application On:

Set up and connect the sine wave generator to a test circuit.

INSTRUCTIONAL MATERIALS

Textbooks:

Grob, Basic Electronics

A/Vs:

Georgia, Electronics Technology, Phase A, "AC current and Voltage", slide/tape 26-A

Student Manuals:

a. Heathkit, Electronic Circuits, Student Workbook
b. Georgia, Electronics Technology, Phase A, Unit 26-A
c. MAVCC, Basic Electronics 1

Tools and Equipment:

a. Manual
b. Sine wave generator
c. Test circuit

CLASSROOM HOURS

12

EVALUATION (ET-12)

a. Given a sine wave generator and a test circuit with required signal specifications, the student will set up the controls to the proper values and connect the generator to the test circuit.

b. Heathkit, AC Electronics, Student Workbook.

c. MAVCC, Basic Electronics 1.

d. Georgia, Electronics Technology, Phase A, Student Tests.

e. V'TECS, Electronics Mechanics, Task No. A-01.

TASK

ET-13 Identifying and using signal generators

PERFORMANCE OBJECTIVE

Set up a signal generator to inject test signals into a test circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Signal generator safety
b. Signal generator control settings
c. Signal generator hook-up to test circuit

Provide Demonstration On:

a. How to use the signal generator manual to set-up the operator controls
b. How to correctly connect the signal generator to a test circuit

Provide Practical Application On:

Demonstrate skills and knowledge of the correct and safe way to set up and connect the signal generator to a test circuit.

INSTRUCTIONAL MATERIALS

Textbooks:

Grob, *Basic Electronics*

Student Manuals:

Georgia, *Electronics*
Phase C, Unit 3-C

Tools and Equipment:

a. Manual
b. Basic signal generator
c. Test circuit

CLASSROOM HOURS

12

EVALUATION (ET-13)

Given a signal generator manual and test circuit with required signal specifications, the student will set up the controls to the proper values and connect the generator to the test circuit.

TASK

ET-14 Identifying and using pulse generators

PERFORMANCE OBJECTIVE

Use the pulse generator to inject the required test signal into a test circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Generator safety
b. Generator control settings
c. Generator hook-up procedures

Provide Demonstration On:

a. How to use the pulse generator manual for a required signal output
b. How to connect the pulse generator to a test circuit

Provide Practical Application On:

Set up and connect the pulse generator to a test circuit.

INSTRUCTIONAL MATERIALS

Textbooks:

Grob, Basic Electronics

Student Manuals:

a. Heathkit, AC Electronics, Student Workbook
b. MAVCC, Basic Electronics 1

Tools and Equipment:

a. Manual
b. Pulse generator
c. Test circuit

CLASSROOM HOURS

12

EVALUATION (ET-14)

Given a pulse generator, manual and test circuit with required signal parameters, the student will demonstrate to the instructor the correct way to set up the controls and how to hook-up to generator to the test circuit.

TASK

ET-15 Identifying and using square wave generators

PERFORMANCE OBJECTIVE

Use a square wave generator to inject the proper test signal into a circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Generator safety
b. Generator control settings and adjustments
c. Generator hook-up procedures
d. Generator testing procedures

Provide Demonstration On:

a. How to use the square wave generator manual to set up a required output signal
b. How to correctly connect the square wave generator to a test circuit

Provide Practical Application On:

Set up and connect the signal generator to a test circuit.

INSTRUCTIONAL MATERIALS

Textbooks:

Grob, Basic Electronics

Student Manuals:

a. Heathkit, DC Electronics, Student Workbook
b. MAVCC, Basic Electronics 1

Tools and Equipment:

a. Manual
b. Square wave generator
c. Test circuit with specifications

CLASSROOM HOURS

12

EVALUATION (ET-15)

a. Given a square wave generator, manual and test circuit with required signal parameters, the student will demonstrate to the instructor how to set the controls of the square wave generator for the required output and how to connect the generator to the test circuit.

b. Heathkit, AC Electronics, Student Workbook.

c. MAVCC, Basic Electronics 1.

TASK

ET-16 Identifying and using impedance testers

PERFORMANCE OBJECTIVE

Use an impedance tester to measure impedance of a test circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Impedance tester control settings
c. Impedance tester hook-up procedures
d. Impedance tester readings

Provide Demonstration On:

a. How to use the impedance manual to set up the test controls
b. How to correctly connect the impedance tester for circuit measurements
c. How to interpret meter readings

Provide Practical Application On:

Hook-up and set up operator controls and read the impedance tester meter readings.

INSTRUCTIONAL MATERIALS

Student Manuals:

a. Heathkit, AC Electronics, Student Workbook
b. MAVCC, Basic Electronics 1

Tools and Equipment:

a. Manual
b. Impedance tester
c. Test circuit

CLASSROOM HOURS 12

EVALUATION (ET-16)

Given an impedance tester, manual and test circuit with reactive components, the student will set up and measure unknown impedance values. All readings must be within 5% of actual values.

TASK

ET-17 Identifying and using frequency meters

PERFORMANCE OBJECTIVE

Set up and operate a frequency meter in a frequency test procedure.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Equipment safety
b. Equipment control settings
c. Equipment hook-up procedures

Provide Demonstration On:

a. How to use the frequency manual to adjust controls for testing
b. How to correctly connect and measure the frequency of a test circuit

Provide Practical Application On:

Use the frequency meter to test a circuit.

INSTRUCTIONAL MATERIALS

Textbooks:

Grob, Basic Electronics

Student Manuals:

a. Heathkit, AC Electronics, Student Workbook
b. MAVCC, Basic Electronics 1

Tools and Equipment:

a. Manual
b. Frequency meter
c. Test circuit to be measured

CLASSROOM HOURS

12

EVALUATION (ET-17)

Given a frequency meter, manual and test circuit, the student will use the meter to make a frequency measurement. Readings must be within 5% of known frequencies.

TASK

ET-18 Understanding fundamentals of electrical theory and electrical measurement

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the fundamentals of electrical theory and the use of electric test meters and circuit diagram symbols.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Atoms
b. Electrons
c. Voltage
d. Current
e. Resistance
f. Electrical measurements and circuits
    1. Ammeter
    2. Voltmeter
    3. Ohmmeter
    4. Circuits
    5. Fuses
    6. Symbols
    7. Circuit diagrams

Provide Demonstration On:

Electric test meters

Provide Practical Application On:

Making basic electrical measurements in a DC circuit using test meters

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. MAVCC, Basic Electronics 1
c. Singer, Basic Mathematics for Electricity and Electronics
d. Georgia, Electronics Technology, Phase A

Student Manuals:

Georgia, Electronics Technology, Phase A, Unit 9A

Tools and Equipment:

a. Ammeter
b. Voltmeter
c. Ohmmeter
d. Fuses
e. Live DC circuit

CLASSROOM HOURS 12

EVALUATION (ET-18)

a. Given a diagram of an atom the student will correctly identify electrons, protons, neutrons, the nucleus and orbit.

b. Given a list of basic electrical terms and definitions covered in the unit, the student will correctly match each term with its defintion.

c. Given a chart of electrical symbols covered in the unit, the student will correctly identify all symbols on the chart.

d. Given a set of circuit diagrams covered in the unit, the student will correclty identify the components in each diagram.

e. Given an ammeter, a voltmeter and an ohmmeter the student will correctly identify each meter and describe its basic function as covered in the unit.

f. Test and review questions are available in:
   1. Singer, Chapter 1.
   2. MAVCC, Unit 1.
   3. Georgia, Electronics Technology, Phase A, Student Tests, Unit 9-A.
   4. Grob, Basic Electronics.

TASK

ET-19 Making calculations using Ohm's law

PERFORMANCE OBJECTIVE

Make calculations with the Ohm's law formula using fractions, decimals and exponents.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Fractions
b. Ohm's law
c. Decimal numbers
d. The metric system
e. Formulas
f. Positive and negative numbers
g. Exponents
h. Equations

Provide Practical Application On:

a. Solving for electrical values using Ohm's law
b. Experimentally verify Ohm's law calculations
c. Solving algebraic equations using exponents

INSTRUCTIONAL MATERIALS

Textbooks:

a. MAVCC, Basic Electronics 1
b. Singer, Basic Mathematics for Electricity and Electronics
c. Georgia, Electronics Technology, Phase A
d. Grob, Basic Electronics

Student Manuals:

a. Meade, Programmed Projects
b. Georgia, Electronics Technology, Phase A, Unit 15-A

Tools and Equipment:

a. VOM
b. Basic Electricity/ Electronics Trainer
c. Variable voltage DC supply

CLASSROOM HOURS

6

EVALUATION (ET-19)

a. Given the Ohm's law formula and a set of problems involving fractions, decimals, positive and negative numbers and exponents, the student will correctly calculate the missing values.

b. Test and review questions can be found in:
   1. Singer, Chapters 2 and 3.
   2. MAVCC, Unit IX.
   3. Georgia, Electronics Technology, Phase A, Student Tests, Unit 15-A.
   4. Grob, Basic Electronics.

TASK

ET-20 Measuring current in DC circuits

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of fundamentals of direct electrical current and measure current in a live DC circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Composition of matter
b. Electrostatics
    1. Coulomb's Law
    2. Ions
    3. Sources of electricity
c. Current flow
    1. Conductors and insulators
    2. Batteries
    3. Random drift and directed drift
d. Electric circuit
e. Measuring current
    1. The Coulomb
    2. Powers of ten and scientific notation
    3. The ampere, milliamps and microamps
    4. Ammeters
f. Charging units of measurement

Provide Practical Application On:

Measuring direct current in a live circuit using a VOM

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. MAVCC, Basic Electronics I
c. Singer, Basic Mathematics for Electricity and Electronics
d. Heathkit, DC Electronics
e. Georgia, Electronics Technology, Phase A

A/Vs:

Georgia, Electronics Technology, Phase A, "Measuring Electrical Current", slide/tape 10-A

Student Manuals:

a. Heathkit, DC Electronics, Student Workbook
b. Georgia, Electronics Technology, Phase A, Units 10-A and 13-A

Tools and Equipment:

a. Breadboarding trainer
b. VOM
c. DC variable power supply

CLASSROOM HOURS 6

EVALUATION (ET-20)

a. Given a live DC circuit and a VOM, the student will correctly measure and compare at two points on the circuit, at two different power levels. The student will correctly convert amps to milliamps and microamps.

b. Test and review questions can be found in:
   1. Heathkit, DC Electronics, Unit 1; Student Workbook, Unit 1.
   2. Singer, Chapter 3.
   3. MAVCC, Unit II.
   4. Georgia, Electronics Technology, Phase A, Student Tests, Units 10-A and 13-A.

TASK

ET-21 Measuring voltage in DC circuits

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the fundamentals of electrical voltage and the ability to measure voltage in a given DC circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Voltage
b. Electromotive force
c. Potential difference
d. Batteries
    1. Dry cell
    2. Lead-acid
e. Battery connections
    1. Series aiding
    2. Series opposing
    3. Parallel
    4. Series parallel
f. Voltage rises and voltage drops
g. The concept of ground
h. Measuring voltage
i. Shorts and opens
j. Soldering

Provide Demonstration On:

a. Measuring voltage
b. Voltage rises and voltage drops
c. Shorts and opens

Provide Practical Application On:

Measuring voltage rises and voltage drops

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. MAVCC, Basic Electronics 1
c. Heathkit, DC Electronics
d. Georgia, Electronics Technology, Phase A

A/Vs:

Georgia, Electronics Technology, Phase A, "Measuring Electrical Voltage", slide/tape 11-A

Student Manuals:

a. Heathkit, DC Electronics, Student Workbook
b. Georgia, Electronics Technology, Phase A, Units 11-A and 24-A
c. Meade, Programmed Projects

Tools and Equipment:

a. ET-3100 Electronic Design Experimenter or equivalent
b. Voltmeter with test leads

(Continued on back)

CLASSROOM HOURS 6

EVALUATION (ET-21)

a. Given a live DC circuit and a voltmeter, the student will correctly measure the applied voltage and voltage drops.

b. Test and review questions can be found in:
   1. Heathkit, DC Electronics, Unit 2; Student Workbook, Unit 2.
   2. MAVCC, Unit X.
   3. Georgia, Electronics Technology, Phase A, Student Tests, Units 11-A and 24-A.
   4. Grob, Basic Electronics.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

c. 1000 ohm, 1%, ½-watt resistor
d. 2 1000 ohm, 5%, ½-watt resistors
e. Slide switch
f. Soldering iron and solder

TASK

ET-22 Calculating and measuring resistance in DC circuits

PERFORMANCE OBJECTIVE

Calculate and measure partial and total resistance in DC series and parallel circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The ohm
b. Resistivity
c. Conductance
d. Factors determining resistance
e. Resistors
   1. Types
   2. Connecting
f. Measuring resistance
   1. In series
   2. In parallel
g. Light dependent resistors
h. Resistor color code

Provide Practical Application On:

a. Color code
b. Using the ohmmeter
c. Measuring resistance
d. Light dependent resistors

INSTRUCTIONAL MATERIALS

Textbooks:

a. MAVCC, Basic Electronics 1
b. Heathkit, DC Electronics
c. Georgia, Electronics Technology, Phase A

A/Vs:

a. Georgia, Electronics Technology, Phase A, "Resistor Color Code", slide/tape 8-A (Part #1)

(Continued on back)

Student Manuals:

a. Heathkit, DC Electronics
b. Georgia, Electronics Technology, Phase A, Units 8-A and 12-A

Tools and Equipment:

a. Assorted resistor
b. VOM
c. Variable DC power supply

CLASSROOM HOURS

12

EVALUATION (ET-22)

a. Given a live DC resistive circuit and an ohmmeter, the student will accurately identify the resistor types and values in the circuit, compute the resistance in the circuit, and measure the resistance in the circuit.

b. Test and review questions can be found in:
   1. Heathkit, DC Electronics, Unit 3; Student Workbook, Unit 3.
   2. Georgia, Electronics Technology, Phase A, Student Tests, Units 8-A and 12-A.
   3. MAVCC, Units X and XI.
   4. Grob, Basic Electronics.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Assorted resistors
e. Ohmmeter with test leads
f. 200 ohm potentiometer
g. 120 ohm thermistor
h. 100 K ohm thermistor
i. Incandescent lamp #49
j. Lamp socket
k. 1/16-amp fuse
l. Soldering iron and solder
m. ET-3100 Electronic Design Experimenter or equivalent
n. Light dependent resistor
o. 220 ohm, 2-watt, 10% resistor

A/Vs:

b. Georgia, Electronics Technology, Phase A, "Use of the Ohmmeter", slide/tape 8-A (Part #2)
c. Georgia, Electronics Technology, Phase A, "Using the Ohmmeter to Troubleshoot", slide/tape 12-A

TASK

ET-23 Calculating voltage, current and resistance in DC series circuits

PERFORMANCE OBJECTIVE

Demonstrate the ability to calculate voltage, current and resistance in DC series circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Voltage in series circuits
b. Current in series circuits
c. Resistance in series circuits
d. Using Ohm's law
   1. For part of a series circuit
   2. For total values in a series circuit
e. Control of current in series circuits
f. Formulas involving addition and subtraction
g. Use of the memory wheel for solving problems

Provide Practical Application On:

Locating faulty components in a series circuit using a voltmeter

INSTRUCTIONAL MATERIALS

Textbooks:

a. MAVCC, Basic Electronics 1
b. Singer, Basic Mathematics for Electricity and Electronics
c. Grob, Basic Electronics
d. Georgia, Electronics Technology, Pnase A

Student Manuals:

a. Meade, Programmed Projects
b. Georgia, Electronics Technology, Phase A, Unit 18-A

Tools and Equipment:

a. Variable voltage power supply
b. Single-pole single-throw switch
c. Two #47 bulbs
d. Voltmeter

CLASSROOM HOURS

12

EVALUATION (ET-23)

a. Given a set of live DC series circuits with various combinations of voltage, resistors and amperage, the student will correctly calculate the unknown values of total voltage and voltage drops, resistance or amperage in each circuit and verify the calculations using a VOM.

b. Test and review questions can be found in:
   1. Singer, Chapter 4.
   2. MAVCC, Unit X.
   3. Georgia, Electronics Technology, Phase A, Student Tests, Unit 18-A.
   4. Grob, Basic Electronics.

TASK

ET-24 Calculating total voltage, total current and total resistance in DC parallel circuits

PERFORMANCE OBJECTIVE

Demonstrate the ability to calculate the total voltage, total current and total resistance in parallel circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Total voltage in parallel circuits
b. Total current in parallel circuits
c. Total resistance in parallel circuits
d. Using Ohm's law
e. Division of current in a parallel circuit
f. Addition and subtraction of fractions
g. Fractions in formulas and equations
h. Opens and shorts in parallel circuits

Provide Practical Application On:

Hooking up, measuring and analyzing parallel circuits

INSTRUCTIONAL MATERIALS

Textbooks:

a. MAVCC, Basic Electronics 1
b. Singer, Basic Mathematics for Electricity and Electronics
c. Georgia, Electronics Technology, Phase A
d. Grob, Basic Electronics

Student Manuals:

a. Georgia, Electronics Technology, Phase A, Unit 19-A
b. Meade, Programmed Projects

Tools and Equipment:

a. Assorted resistors
b. Variable DC power supply
c. VOM

CLASSROOM HOURS

12

EVALUATION (ET-24)

a. Given a live parallel resistive DC circuit containing resistors of different values, the student will accurately calculate and measure the voltage, current and resistance of parts of the circuit and for the total circuit using appropriate meters.

b. Test and review questions can be found in:
   1. MAVCC, Unit XI.
   2. Singer, Chapter 5.
   3. Georgia, Electronics Technology, Phase A, Student Tests, Unit 19-A.
   4. Grob, Basic Electronics.

TASK

ET-25 Calculating and measuring electrical quantities in combination DC circuits

PERFORMANCE OBJECTIVE

Using circuit diagrams and live DC circuits, calculate and measure voltage, current and resistance in combination circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Combination circuits
b. Simplifying series-parallel circuits
c. Equivalent circuits
d. Voltage dividers
e. Grounds and voltage polarity
f. Opens and shorts
g. Schematic symbols

Provide Demonstration On:

a. Steps in simplifying a series parallel circuit
b. A voltage divider .

Provide Practical Application On:

a. Measuring and calculating quantities in combination circuits
b. Constructing a voltage divider

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. MAVCC, Basic Electronics 1
c. Singer, Basic Mathematics for Electricity and Electronics
d. Georgia, Electronics Technology, Phase A

Student Manuals:

a. Georgia, Electronics Technology, Phase A, Unit 20-A
b. Meade, Programmed Projects

Tools and Equipment:

a. DC power supply
b. VOM
c. Two 1000, one 1500, and two 2200 ohm resistors, ½W
d. Switch, SPST
e. 12-v lamp or equivalent

CLASSROOM HOURS

12

EVALUATION (ET-25)

a. Using the components listed for this unit, the student will diagram a series parallel circuit, will calcualte the total and branch quantities and will then construct the live circuit and measure the electrical quantities.

b. Test and review questions can be found in:
   1. Singer, Chapter 6.
   2. Georgia, Electronics Technology, Phase A, Student Tests, Unit 20-A.
   3. Grob, Basic Electronics.
   4. Meade, Programmed Projects.

TASK

ET-26 Calculating power in DC circuits

PERFORMANCE OBJECTIVE

Calculate power in DC circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Ohm's law
   1. Finding current
   2. Finding voltage
   3. Finding resistance
b. Power and wattage
   1. Work and power
   2. Current, voltage and power
   3. Power dissipation in resistors
   4. Total power in electric circuits
c. Equations derived from Ohm's law and the basic power formula
d. Finding the square root of a number

Provide Practical Application On:

a. Verifying Ohm's law
b. Calculating power

INSTRUCTIONAL MATERIALS

Textbooks:

a. MAVCC, Basic Electronics 1
b. Singer, Basic Mathematics for Electricity and Electronics
c. Heathkit, DC Electronics
d. Georgia, Electronics Technology, Phase A
e. Grob, Basic Electronics

Student Manuals:

a. Georgia, Electronics Technology, Phase A, Unit 16-A
b. Meade, Programmed Projects

Tools and Equipment:

a. ET-3100 Electronic Design Experimenter or equivalent
b. Volt-ohm-meter
c. 1000 ohm, 1% resistor
d. 100 ohm, 1% resistor

(Continued on back)

CLASSROOM HOURS 6

EVALUATION (ET-26)

a. Given the equipment, components and test instruments listed in this unit, the student will diagram a simple DC circuit, construct the cirucit, measure the electrical quantities and accurately calculate watts of power in the circuit.

b. Test and review questions can be found in:
   1. Heathkit, DC Electronics, Unit 4.
   2. Georgia, Electronics Technology, Phase A, Student Tests, Unit 16-A.
   3. Meade, Programmed Projects.
   4. MAVCC, Units VII and IX.
   5. Singer, Chapter 7.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

e. 1200 ohm 5% resistor, .5W
f. 22K ohm 5% resistor, .5W
g. 33K ohm, 5%, ½ watt resistor
h. 1K ohm, 1% resistor
i. 2K ohm, 5%, ½ watt resistor
j. 100K ohm potentiometer
(built into ET-3100)

TASK

ET-27 Applying fundamentals of magnetism and electromagnetism

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the fundamentals of magnetism and electromagnetism and of their applications in electronic devices.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The magnetic field
   1. Lines of force
   2. Theory of magnetism
b. Electricity and magnetism
   1. Current flow and magnetism
   2. The electromagnet
   3. Magnetic quantities
   4. Ohm's law for magnetic quantities
   5. Systems of measurement for magnetic quantities
c. Induction
   1. Magnetic induction
   2. Electromagnetic induction

(Continued on next page)

Provide Demonstration On:

a. Illustration of the magnetic field using a magnet and iron filings
b. Examples of common applications of magnets and electromagnets

Provide Practical Application On:

Constructing and demonstrating the properties of an electromagnet

INSTRUCTIONAL MATERIALS

Textbooks:

a. MAVCC, Basic Electronics 1
b. Heathkit, DC Electronics
c. Georgia, Electronics Technology, Phase A
d. Grob, Basic Electronics

A/Vs:

Georgia, Electronics Technology, Phase A, "Basic Introduction to Magnetism", slide/tape 25-A

Student Manuals:

Georgia, Electronics Technology, Phase A, Unit 25-A

Tools and Equipment:

(Continued on back)

CLASSROOM HOURS 6

EVALUATION (ET-27)

a. Given an assortment of magnetic and electromagnetic devices, the student will correctly identify by name, describe the function and application of each device and compute the ampere-turns magnetic strength of an electromagnet in a given circuit.

b. Test and review questions can be found in:
   1. Heathkit, *DC Electronics*, Unit 5.
   2. MAVCC, Unit XIII.
   3. Georgia, *Electronics Technology, Phase A, Student Tests*, Unit 25-A.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

d. Applications of magentism and electromagnetism
   1. AC generator
   2. DC generator
   3. Relay
   4. Reed switch and relay
   5. Record pickup
   6. Loudspeaker
   7. Magnetic tape
   8. DC motor
   9. Meter
   10. Computer memories
   11. Magnetic deflection of electron beams

e. The left-hand rule
   1. For coils
   2. For conductors

INSTRUCTIONAL MATERIALS

Tools and Equipment:

a. ET-3100 Electron Design Experimenter or equivalent
b. Volt-ohm-meter
c. Compass
d. 100 ohm, 2-watt, 10% resistor
e. Slide switch
f. Hook-up wire
g. Permanent magnet
h. Magnetic reed switch
i. Relay
j. Incandescent lamp
k. Lamp socket
l. Soldering iron and solder
m. 1K ohm potentiometer (built into ET-3100)

TASK

ET-28 Using test instruments to measure voltage, current and resistance

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of meter movement and how it is used to measure current, voltage and resistance.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. VOM meter movement
  1. Construction
  2. Operation
  3. Taut-band movement

b. The ammeter
  1. Increasing the range
  2. Computing shunt resistance
  3. Accuracy

c. The voltmeter
  1. Extending the range
  2. Calculating the multiplier
  3. Multiple-range voltmeters
  4. Sensitivity
  5. Loading effect

d. The ohmmeter
  1. Scale calibration
  2. Creating higher and lower ranges
  3. The shunt ohmmeter

e. Multimeters
  1. Electronic multimeters
  2. Inaccuracies in measuring

Provide Practical Application On:

a. Determining the sensitivity of a voltmeter
b. Loading effects of the voltmeter
c. Extending the current range of meters

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Electronics Technology, Phase A
b. Grob, Basic Electronics
c. Heathkit, DC Elctronics
d. MAVCC, Basic Electronics 1

A/Vs:

(Continued on back)

Student Manuals:

a. Georgia, Electronics Technology, Phase A, Units 14-A and 22-A
b. Heathkit, DC Electronics
c. Meade, Programmed Projects

Tools and Equipment:

(Continued on back)

CLASSROOM HOURS

14

EVALUATION (ET-28)

a. Given the tools and equipment listed for this unit, the student will demonstrate the proper use and care of electrical test instruments, including the use of the Ayrton Shunt to extend the current range of meters.

b. Test and review questions can be found in:
   1. Grob, Basic Electronics.
   2. Meade, Programmed Projects.
   3. Georgia, Electronics Technology, Phase A, Units 14-A and 22-A.
   4. Heathkit, DC Electronics.
   5. MAVCC, Basic Electronics, 1.

INSTRUCTIONAL MATERIALS

A/Vs:

a. Georgia, Electronics Technology, Phase A, "Proper Use and Care of Meters", slide/tape 14-A
b. Georgia, Electronics Technology, Phase A, "The Ayrton or Universal Meter Shunt", slide/tape 22-A

Tools and Equipment:

a. VOM
b. VTVM
c. Basic Electricity/Electronics Trainer
d. Variable voltage DC power supply
e. Variable voltage AC power supply
f. 10M ohm, ½-watt, 10% resistor
g. 100K ohm potentiometer
h. 100 ohm, ½-watt, 1% resistor
i. 220K ohm, ½-watt, 5% resistor
j. 1M ohm, ½-watt, 5% resistor
k. 10M ohm, ½-watt, 10% resistor
l. 1K ohm potentiometer

TASK

ET-29 Calculating values in DC network circuits

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the fundamentals of DC circuits and the ability to analyze simple networks by applying the network theorems.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Simple circuits
b. Voltage dividers
c. Bridge circuits
  1. Balance bridge
  2. Unbalanced bridge
  3. Applications of the bridge circuit
d. Kirchhoff's law
  1. Kirchhoff's voltage law
  2. Kirchhogg's current law
e. Superposition theorem
f. Thevenin's theorem
g. Norton's theorem
h. Maximum power transfer theorem

Provide Practical Application On:

a. Bridge circuits
b. Maximum power transfer theorem
c. Series voltage dividers
d. Parallel current dividers

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Georgia, Electronics Technology, Phase A
c. Heathkit, DC Electronics
d. MAVCC, Basic Electronics 1

Student Manuals:

a. Meade, Programmed Projects
b. Georgia, Electronics Technology, Phase A, Unit 21-A
c. Heathkit, DC Electronics

Tools and Equipment:

a. ET-3100 Electronic Design Experimenter or equivalent
b. Volt-ohm-meter with test leads

(Continued on back)

CLASSROOM HOURS

4

EVALUATION (ET-29)

a. Given the tools and equipment listed for this unit, the student will diagram, construct and test the following circuits:
   1. A three resistor series voltage divider in which $E_{R1} = E_{R3}$, $I_T = 5MA$ and $E_{A2} = 60V$.
   2. A three resistor parallel current divider in which I_{R3} is one-third of I_{R1} and R_2 is twice R_1.
   3. A balanced Wheatstone Bridge

b. Test and review questions can be found in:
   1. Grob, Basic Electronics.
   2. Georgia, Electronics Technology, Phase A, Unit 21-A.
   3. Heathkit, DC Electronics.
   4. MAVCC, Basic Electronics 1.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

c. 470 ohm ½-watt 5% resistor
d. 68 ohm ½-watt 5% resistor
e. 1000 ohm ½-watt 1% resistor
f. 1000 ohn ½-watt 5% resistor
g. 100 ohm ½-watt 1% resistor
h. 100 ohm ½-watt 5% resistor
i. 200 ohm ½-watt 5% resistor
j. 68 ohm ½-watt 5% resistor
k. 10 ohm ½-watt 1% resistor
l. 22 ohm ½-watt 5% resistor
m. 10K ohm ½-watt 5% resistor
n. 2200 ohm ¼-watt 5% resistor
o. 4700 ohm ½-watt 5% resistor
p. 5100 ohm ½-watt 5% resistor
q. 100K ohm potentiometer
   (built into ET-3100)
r. Slide switch, DPDT

TASK

ET-30 Calculating capacitance and time constants for RC circuits

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the fundamentals of inductance and capacitance and the ability to calculate total capacitance in networks and RC time constants.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Inductance
   1. Self-induction
   2. Inductors
   3. Schematic symbols for the inductor
   4. Time constant of an inductor
   5. Unit of inductance
b. Capacitance
   1. Unit of capacitance
   2. Factors determining capacitance
c. Capacitors
   1. Charging the capacitor
   2. Discharging the capacitor

(Continued on back)

Provide Demonstration On:

a. Types of inductors and capacitors
b. Mathematical applications for calculating inductance and capacitance in RC circuits

Provide Practical Application On:

Diagraming, constructing calculating parameters and measuring values in series and parallel RC circuits

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Georgia, Electronics Technology, Phase A
c. Heathkit, DC Electronics
d. MAVCC, Basic Electronics 1

Student Manuals:

a. Meade, Programmed Projects
b. Georgia, Electronics Technology, Phase A, Unit 33-A
c. Heathkit, DC Electronics

Tools and Equipment:

a. ET-3100 Electronic Design Experimenter or equivalent
b. Volt-ohm-meter with test leads

(Continued on back)

CLASSROOM HOURS

6

EVALUATION (ET-30)

a. Given the tools and equipment listed for this unit, the student will diagram, construct and calculate the parameters of and measure to values in a series RC circuit and in a parallel RC circuit.

b. Test and review questions can be found in:
   1. Grob, Basic Electronics.
   2. Meade, Programmed Projects.
   3. MAVCC, Units V and VI.
   4. Georgia, Electronics Technology, Phase A, Unit 33-A.
   5. Heathkit, DC Electronics.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

   3. Types of capacitors
   4. Schematic symbol for the capacitor

d. RC time constants
e. Capacitors in combination
   1. In parallel
   2. In series
f. Mathematical applications
   1. Calculating total capacitance in networks
   2. Calculating RC time constants
   3. Solving time-constant problems

INSTRUCTIONAL MATERIALS

Tools and Equipment:

c. 50 mfd 15 volt electrolytic capacitor
d. 500 mfd 15 volt electrolytic capacitor
e. 100 ohm ½-watt 5% resistor
f. DPDT slide switch
g. Clock or watch with sweep-second hand
h. 100K ohm potentiometer (built into ET-3100)
i. 10 mfd electrolytic capacitor
j. 100 ohm 2-watt 10% resistor
k. Lamp socket
l. Lamp
m. Relay

TASK

ET-31 Calculating values for a right triangle

PERFORMANCE OBJECTIVE

Demonstrate the ability to calculate the unknown values of a right triangle by using trigonometric functions.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Angles
b. Radians
c. Triangles
d. Right triangles
    1. Finding the acute angles
    2. Finding the sides
e. Trigonometric formulas
    1. Tangent of an angle
    2. Sine of an angle
    3. Cosine of an angle
f. Using the table of trigonometric functions

Provide Demonstration On:

Illustrating the properties of a right triangle

Provide Practical Application On:

Using trigonometric formulas

INSTRUCTIONAL MATERIALS

Textbooks:

Singer, *Basic Mathematics for Electricity and Electronics*

CLASSROOM HOURS 6

EVALUATION (ET-31)

a. Given a set of trigonometric problems and a table of trigonometric functions, the student will correctly solve for unknown values.

b. Test and review questions can be found in Singer, Basic Mathematics for Electricity and Electronics.

TASK

ET-32 Identifying the characteristics of AC sine waves

PERFORMANCE OBJECTIVE

Demonstrate knowledge of the characteristics and applications of alternating current, knowledge of the operation of a simple AC generator and the ability to analyze an AC sine wave for appropriate AC values.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Difference between alternating current and direct current
b. Practical applications of alternating current
c. Generating alternating current
    1. Electromagnetic induction
    2. Simple alternating current generator
d. The sinusoidal wave form of AC voltage or current
    1. Frequency
    2. Period
    3. Wave length

Provide Demonstration On:

a. Use of the oscilloscope
b. Interpreting wave forms

Provide Practical Application On:

Using the oscilloscope to measure AC values

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, AC Electronics
b. MAVCC, Basic Electronics I
c. Georgia, Electronics Technology, Phase A

A/Vs:

Georgia, Electronics Technology, Phase A, "Introduction to Basic Oscilloscope Controls", slide/tape 28-A

Student Manuals:

Georgia, Electronics Technology, Phase A, Unit 28-A

Tools and Equipment:

a. Oscilloscope
b. Audio frequency generator
c. DC variable power supply
d. AC variable power supply
e. VOM
f. Graph paper

(Continued on back)

CLASSROOM HOURS

6

EVALUATION (ET-32)

a. Using the equipment listed for this task and a 10 unit diameter circle, the student will construct a graph of a sine wave cycle with 15 degree increments and will calculate the RMS value.

b. Test and review questions can be found in:

1. MAVCC, Basic Electronics I.
2. Heathkit, AC Electronics.
3. Georgia, Electronics Technology, Phase A, Unit 28-A.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

e. AC values
    1. Peak value
    2. Peak-to-peak value
    3. Average value
    4. Effective value
    5. Period
    6. Frequency
f. Nonsinusoidal wave forms
    1. The square wave
    2. The triangular wave
    3. The sawtooth wave
    4. Fluctuating DC waves

INSTRUCTIONAL MATERIALS

Tools and Equipment:

g. Compass
h. Protractor
i. Ruler
j. Calculator

TASK

ET-33 Measuring AC values for LF circuits

PERFORMANCE OBJECTIVE

Demonstrate knowledge of the basic test instruments which measure AC values, the ability to analyze simple AC circuits containing only resistance and the ability to use AC meters to measure AC voltage and current.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of AC meters
    1. Rectifier-type, moving coil meters
    2. Moving-vane meters
    3. Thermocouple meters
    4. Clamp-on meters
b. Using AC meters
c. Oscilloscopes
d. AC circuits containing only resistance
    1. Basic AC circuit calculations
    2. Series AC circuit calculations
    3. Parallel AC circuit calculations
    4. Power in AC circuits

Provide Demonstration On:

a. Types of AC meters
b. Proper operation of AC meters
c. Measuring voltage and current in an AC circuit

Provide Practical Application On:

a. Using test instruments to measure voltage and current in simple AC circuits
b. Making calculations in AC circuits

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, AC Electronics
b. Training and Retraining, Inc., Basic Electricity/Electronics
c. Grob, Basic Electronics
d. Georgia, Electronics Technology, Phase A

A/V's:

Georgia, Electronics Technology, Phase A, "Important AC Units and Terms", slide/tape 26-A

Student Manuals:

a. Georgia, Electronics Technology, Phase A, Unit 26-A
b. Heathkit, AC Electronics

Tools and Equipment

a. Experimenter or 15v, 60 Hz source
b. VOM
c. 470 ohm, 1/2-watt resistor
d. 1 K ohm, 1/2-watt resistor
e. Oscilloscope
f. Audio generator

CLASSROOM HOURS

6

EVALUATION (ET-33)

a. Given a set of simple, series and parallel AC circuits containing only resistance, the student will correctly calculate electrical quantities and correctly measure voltage and current in the circuits using AC test meters.

b. Test and review questions can be found in:

   1. Heathkit, AC Electronics.
   2. Grob, Basic Electronics.
   3. Georgia, Electronics Technology, Phase A, Unit 26-A.

TASK

ET-34 Determining reactance and impedance of a capacitor in either series or parallel circuits

PERFORMANCE OBJECTIVE

Demonstrate the ability to calculate the reactance and impedance of a capacitor and the total capacitance of capacitors in series and in parallel in AC circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Structure and function of a capacitor
b. Capacitance
c. Capacitors in parallel
d. Capacitors in series
e. Reactance of a capacitor
f. Impedance of a capacitor
g. Measurement of capacitance
h. Capacitor types
i. Color code
j. Symbols
k. Charging and discharging

Provide Demonstration On:

a. Types of capacitors
b. Symbols
c. Charging and discharging

Provide Practical Application On:

a. Charging and discharging
b. Using a capacitor testor
c. Calculating reactance and impedance

INSTRUCTIONAL MATERIALS

Textbooks:

a. Singer, Basic Mathematics for Electricity and Electronics
b. Georgia, Electronics Technology, Phase A
c. Grob, Basic Electronics
d. Training and Retraining, Inc., Basic Electricity/Electronics
e. Duarte, Electronics Assembly and Fabrication Methods
f. Heathkit, AC Electronics

Student Manuals:

a. Meade, Programmed Projects
b. Georgia, Electronics Technology, Phase A, Unit 31-A
c. Heathkit, AC Electronics

Tools and Equipment:

Various types of capacitors

CLASSROOM HOURS

6

EVALUATION (ET-34)

a. Given a set of diagrams of simple, series and parallel AC circuits containing capacitance, the student will correctly calculate impedance, reactance and capacitance.

b. Test and review questions can be found in:

1. Singer, Basic Mathematics for Electricity.
2. MAVCC, Basic Electronics I.
3. Grob, Basic Electronics.
4. Georgia, Electronics Technology, Phase A, Unit 31-A.
5. Heathkit, AC Electronics.

TASK

ET-35 Calculating and measuring electrical values in AC capacitance circuits

PERFORMANCE OBJECTIVE

Demonstrate knowledge of the characteristics and practical applications of capacitors in AC circuits, the ability to take AC circuit measurements and the ability to calculate AC circuit values.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Capacitors in AC circuits
   1. Current-voltage relationships
   2. Capacitive reactance
   3. Ohm's law in capacitance circuits
b. RC circuits
   1. Series RC circuits
   2. Impedance
   3. Phase shift
   4. Power in AC circuits
   5. Parallel RC circuits
c. Applications of capacitive circuits

(Continued on back)

Provide Practical Application On:

a. RC circuits
b. Capacitor applications
c. Calculating capacitive reactance in series and parallel circuits

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, *AC Electronics*
b. MAVCC, *Basic Electronics I*
c. Grob, *Basic Electronics Technology, Phase A*

Student Manuals:

a. Meade, *Programmed Projects*

(Continued on back)

Tools and Equipment:

a. Experimenter or 30 VAC, 60 Hz source and sine wave signal generator
b. AC voltmeter
c. .001 microfarad capacitor
d. .039 microfarad capacitor
e. .1 microfarad capacitor
f. .47 microfarad capacitor
g. 4.7 k ohm ½-watt resistor
h. 47 k ohm ½-watt resistor

CLASSROOM HOURS

12

EVALUATION (ET-35)

a. Given a set of diagrams for AC series and parallel capacitive circuits, the student will correctly calculate the capacitive reactance in the circuits and determine the phase relationship between E and I.

b. Test and review questions can be found in:
   1. Grob, Basic Electronics.
   2. Meade, Programmed Projects.
   3. Heathkit, AC Electronics.
   4. Georgia, Electronics Technology, Phase A, Unit 32-A.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

1. Capacitive voltage dividers
2. Low-pass filter
3. High-pass filter
4. Decoupling network
5. Coupling network
6. Phase shift network

INSTRUCTIONAL MATERIALS

Student Manuals:

b. Georgia, Electronics Technology, Phase A, Unit 32-A
c. Heathkit, AC Electronics

TASK

ET-36 Measuring inductance in series RL circuits

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the characteristics and practical applications of inductors in AC circuits and the ability to calculate and measure inductance and inductance reactance in series RF circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

- a. Inductor types and symbols
- b. Inductors in AC circuits
  - 1. Current-voltage relationship
  - 2. Inductive reactance
  - 3. Ohm's law in inductive circuit
  - 4. Mutual inductance
  - 5. Inductors in series and in parallel
  - 6. Q
- c. RL circuits
  - 1. Series RL circuits
  - 2. Impedance
  - 3. Phase shift
  - 4. Power
  - 5. Parallel RL circuits
- d. Applications of inductive circuits

INSTRUCTIONAL MATERIALS

Textbooks:

- a. Heathkit, AC Electronics
- b. MAVCC, Basic Electronics 1
- c. Georgia, Electronics Technology, Phase A
- d. Grob, Basic Electronics

Student Manuals:

- a. Georgia, Electronics Technology, Phase A, Units 27-A, 29-A and 30-A
- b. Meade, Programmed Projects
- c. Heathkit, AC Electronics

Tools and Equipment:

- a. AC voltmeter (Heathkit IM-17 or equivalent)
- b. Experimenter or DC power supply, 30v 60 Hz source, and sine wave
- c. Signal generator
- d. 4.5 henry Iron-core choke
- e. 45 to 110mH Variable inductor
- f. 2 1-kilohm, ½-watt resistor
- g. Neon lamp
- h. Alignment tool

CLASSROOM HOURS

12

EVALUATION (ET-36)

a. Given a diagram of an inductive circuit, the student will draw a diagram illustrating the phase relationship between current and voltage.

b. Given a series RL circuit, the student will compute inductive reactance in ohms when the inductance in henrys and the frequency of operations are known.

c. Given a series RL circuit, the student will calculate the impedance of the circuit.

d. Test and review questions can be found in:

1. Heathkit, AC Electronics.
2. MAVCC, AC Unit III.
3. Meade, Programmed Projects.
4. Grob, Basic Electronics.
5. Georgia, Electronics Technology, Phase A, Units 27-A, 29-A and 30-A.

TASK

ET-37 Computing turns, voltage, current and impedance ratios of transformers

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the characteristics and applications of transformers and the ability to solve problems involving turns ratio, voltage ratio, current ratio and impedance ratio.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Transformer characteristics
   1. Mutual inductance
   2. Transformer action
   3. Transformer construction
   4. Symbols
b. Transformer theory
   1. Transformer with no load
   2. Transformer with load
c. Transformer ratios
   1. Voltage ratio
   2. Power ratio
   3. Current ratio
   4. Solving transformer problems
   5. Impedance ratio
d. Transformer losses
e. Transformer efficiency
f. Transformer applications
   1. Power distribution
   2. Electronic applications
   3. Autotransformer

Provide Demonstration On:

Types of transformers

Provide Practical Application On:

a. The action of a transformer in an AC circuit
b. Solving problems of turns ratio, voltage ratio, current and impedance ratio

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, AC Electronics
b. Grob, Basic Electronics
c. Georgia, Electronics Technology, Phase A

A/Vs:

Georgia, Electronics Technology, Phase A, "Transformer Impedance Ratio", slide/tape 37-A

Student Manuals:

a. Heathkit, AC Electronics
b. Georgia, Electronics Technology, Phase A, Unit 37-A

Tools and Equipment:

a. Experimenter or 15v 60 Hz source
b. Multimeter
c. 10 k ohm to 1740 ohm Audio Driver Transformer
d. 1000, ½-watt resistor

(Continued on back)

CLASSROOM HOURS 12

EVALUATION (ET-37)

a. When supplied with diagrams of transformers, the student will correctly solve problems of turns ratio, voltage ratio, current ratio and impedance ratio.

b. Test and review questions can be found in:
   a. Grob, Basic Electronics.
   b. Georgia, Electronics Technology, Phase A, Unit 37-A.
   c. Heathkit, AC Electronics.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

e. 100, 1/2-watt resistor
f. Filament transformer
   with HV windings

TASK

ET-38 Drawing phasor diagrams and calculating operating values for series AC circuits

PERFORMANCE OBJECTIVE

Demonstrate the ability to draw phasor diagrams and to calculate the values for series AC circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Phasors and phasor diagrams
b. Simple series AC circuits
    1. Containing only resistance
    2. Containing only inductance
    3. Containing only capacitance
c. The Pythagorea theorem
d. More complex series AC circuits
    1. Containing resistance and inductance
    2. Containing resistance and capacitance

(Continued on back)

Provide Demonstration On:

a. Measuring frequency and phase using the oscilloscope
b. Using the Time Measurement and Lissajous Pattern methods for measuring frequency

Provide Practical Application On:

a. Drawing phasor diagrams
b. Using the oscilloscope to measure frequency and phase angle

INSTRUCTIONAL MATERIALS

Textbooks:

a. Singer, Basic Mathematics for Electricity and Electronics
b. Georgia, Electronics Technology, Phase A

A/Vs:

Georgia, Electronics Technology, Phase A, "Measuring Frequency and Phase With a Scope", slide/tape 38-A

Student Manuals:

Georgia, Electronics Technology, Phase A, Unit 38-A

Tools and Equipment:

a. Dual trace oscilloscope
b. Two audio generators
c. Basic electronics trainer

CLASSROOM HOURS

12

EVALUATION (ET-38)

a. Given series AC circuits and the proper tools and equipment, the student will draw phasor diagrams and calculate electrical values for the circuits.

b. Test and review questions can be found in:
   1. Singer, Basic Mathematics for Electricity and Electronics.
   2. Georgia, Electronics Technology, Phase A, Unit 38-A.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

   3. Containing resistance, inductance and capacitance

e. Series resonance
   1. Finding the inductance to produce resonance
   2. Finding the capacitance to produce resonance

f. Values to be determined
   1. Current
   2. Total current
   3. Power
   4. Effective power
   5. Voltage
   6. Resistance
   7. Reactance
   8. Inductance
   9. Inductive reactance
   10. Impedance
   11. Phase angle
   12. Power factor
   13. Voltage drop
   14. Frequency
   15. Angle of lead
   16. Angle of lag
   17. Capacitance
   18. Resonant frequency

TASK

ET-39 Drawing phasor diagrams and calculating operating values for parallel AC circuits

PERFORMANCE OBJECTIVE

Demonstrate the ability to draw phasor diagrams and to calculate the values for parallel AC circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

- a. Simple parallel AC circuits
  - 1. Containing only resistance
  - 2. Containing only inductance
  - 3. Containing only capacitance
- b. More complex parallel AC circuits
  - 1. Containing resistance and inductance
  - 2. Containing resistance and capacitance

(Continued on back)

Provide Demonstration On:

Using the oscilloscope and other test instruments to measure electrical valves in AC parallel circuits

Provide Practical Application On:

- a. Measuring electrical valves in AC parallel circuits
- b. Calculating valves in AC parallel circuits

INSTRUCTIONAL MATERIALS

Textbooks:

- a. Singer, Basic Mathematics for Electricity and Electronics
- b. Georgia, Electronics Technology, Phase A

A/Vs:

Georgia, Electronics Technology, Phase A, "Measuring Frequency and Phase With a Scope", slide/tape 38-A

Student Manuals:

Georgia, Electronics Technology, Phase A, Units 34-A and 38-A

Tools and Equipment:

- a. Dual trace oscilloscope
- b. Two audio generators
- c. Basic electronics trainer
- d. VOM

CLASSROOM HOURS

12

EVALUATION (ET-39)

a. Given parallel AC circuits and the proper tools and equipment, the student will draw phasor diagrams and calculate and measure electrical values for the circuits.

b. Test and review questions can be found in:
   1. Singer, Basic Mathematics for Electricity and Electronics.
   2. Georgia, Electronics Technology, Phase A, Units 34-A and 38-A.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

c. Parallel resonance
   1. Finding the inductance to produce resonance
   2. Finding the capacitance to produce resonance

d. Values to be determined for parallel AC circuits
   1. Current
   2. Total current
   3. Power
   4. Resistance
   5. Total resistance
   6. Reactance
   7. Inductance
   8. Impedance
   9. Total impedance
   10. Phase angle
   11. Power factor
   12. Capacitance
   13. Resonant frequency
   14. Series equivalent circuit
   15. In-phase current
   16. Reactive current

TASK

ET-40 Understanding fundamentals of tuned AC circuits

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the characteristics of series and parallel resonant circuits, a knowledge of the basic types of filters and the ability to analyze RLC circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. RLC circuits
  1. Series RLC circuits
  2. Parallel RLC circuits
b. Resonance
c. Series resonance
d. Q and bandwidth in series resonant circuits
e. LC filters
  1. Band-pass filter
  2. Band-stop filter
  3. Low-pass filter
  4. High-pass filter
g. Solving problems
  1. Calculating values for series and parallel

(Continued on back)

Provide Practical Application On:

a. Series resonance
b. Parallel resonance
c. LC filters and their response curves

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, AC Electronics
b. Grob, Basic Electronics
c. Georgia, Electronics Technology, Phase A

Student Manuals:

a. Georgia, Electronics Technology, Phase A, Units 35-A and 36-A
b. Heathkit, AC Electronics

Tools and Equipment:

a. Experimenter or sine wave signal generator and 100 K ohm potentiometer
b. Volt-ohmmeter
c. AC voltmeter
d. 107 mH coil
e. .001 microfarad ceramic capacitor
f. Two 4700 ohm, ½-watt resistors
g. Two 1000 ohm resistors
h. 10 K ohm, ½-watt resistor
i. .01 microfarad Mylar capacitor

CLASSROOM HOURS

6

EVALUATION (ET-40)

a. Given RLC circuits and the proper test instruments, the student will correctly calculate and measure electrical values.

b. Given LC circuits and the proper test instruments, the student will correctly calculate and measure resonant frequency, capacitance and inductance.

c. Test and review questions can be found in:
   1. Heathkit, *AC Electronics*.
   2. Georgia, Electronics Technology, Phase A, Units 35-A.
   3. Meade, *Programmed Projects*.
   4. Grob, *Basic Electronics*.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

2. Solving for resonant frequency, capacitance and inductance in LC circuits

TASK

ET-41 Understanding fundamentals of semi-conductor materials

PERFORMANCE OBJECTIVE Demonstrate a knowledge of the functions of semi-conductors in electronic equipment, the electrical characteristics of semi-conductor materials and the way that current flows through intrinsic and doped semi-conductors.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Common semi-conductor devices
b. Function of semi-conductors in electronic equipment
    1. Advantages of semi-conductors compared to vacuum tubes
    2. Disadvantages of semi-conductors compared to vacuum tubes
c. Electrical characteristics of semi-conductor materials
    1. Semi-conductor atoms
    2. Semi-conductor crystals

(Continued on back)

Provide Demonstration On:

Types of semi-conductor materials and devices

Provide Practical Application On:

Identifying the types, characteristics and applications of various semi-conductor devices

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics, Phase B
C. Grob, Basic Electronics

A/Vs:

Georgia, Electronics, Phase B, "Semi-Conductor Devices", slide/tape 1-B and "Semi-Conductor Materials", slide/tape 2-B

Student Manuals:

a. Georgia, Electronics, Phase B, Units 1-B and 2-B
b. Heathkit, Semi-Conductor Devices
c. Oleksy, Solid-State Electronics

Tools and Equipment:

a. Various types of semi-conductor devices

(Continued on back)

CLASSROOM HOURS 12

EVALUATION (ET-41)

a. Given various types of semi-conductor devices, the student will identify each type, its characteristics and applications.

b. Given typical germanium and silicon diodes and the tools and equipment listed for this unit, the student will plot the V-I curves for the diodes.

c. Test and review questions can be found in:
   1. Grob, Basic Electronics.
   2. Heathkit, Semi-Conductor Devices.
   3. Georgia, Electronics, Phase B, Units 1-B and 2-B.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

d. Conduction in intrinsic germanium and silicon
   1. Low temperature characterisitcs
   2. High temperature characteristics
   3. Holes
   4. Current flow

e. Conduction in doped germanium and silicon
   1. N-type semi-conductors tors
   2. P-semi-conductors

INSTRUCTIONAL MATERIALS

Tools and Equipment:

b. Basic electricity/ electronics experimenter
c. 1 silicon diode
d. 1 germanium diode
e. 1000 ohm, ½-watt resistor
f. 100 K ohm, ½-watt resistor
g. 1000 ohm potentiometer
h. VOM

TASK

ET-42 Performing a condition test of a semi-conductor diode using an ohmmeter

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the operation, construction, electrical characteristics of and symbols for, semi-conductor diodes and the ability to test diodes with an ohmmeter to determine proper functioning.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The PN junction
b. Diode biasing
    1. Forward bias
    2. Reverse bias
c. Diode characteristics
    1. Germanium diode
    2. Silicon diode
    3. Diode ratings
    4. Effect of temperature
    5. Diode symbols
d. Diode construction
    1. Diode construction
    2. Alloyed junctions
    3. Diffused junctions
    4. Diode packaging
e. Rectification and other applications

Provide Practical Application On:

a. Semi-conductor diode characteristics
b. Testing semi-conductor diodes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics, Phase B
c. Zbar, Basic Electronics

Student Manuals:

a. Georgia, Electronics, Phase B, Unit 3-B
b. Heathkit, Semi-Conductor Devices
c. Oleksy, Solid-State Electronics
d. Zbar, Basic Electronics

Tools and Equipment:

a. Heathkit Electronic Design Experimenter ET-3100 or equivalent
b. Ohmmeter with test leads
c. Voltmeter with test leads
d. Silicon diode
e. Germanium diode
f. 1000 ohm, ½-watt resistor
g. 100 ohm, ½-watt resistor
h. 1000 ohm potentiometer

CLASSROOM HOURS 6

EVALUATION (ET-42)

a. Given a germanium diode, a silicon diode and an ohmmeter, the student will test the condition of the diodes to determine if they are good or bad.

b. Test and review questions can be found in:
   1. Georgia, Electronics, Phase B, Unit 3-B.
   2. Heathkit, Semi-conductor Devices.

TASK

ET-43 Performing a condition test of zener diodes used in regulator circuits

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the operation and electrical characteristics of, and symbols for, zener diodes and the ability to design a zener regulator circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Zener diode characteristics
    1. Voltage-current characteristics
    2. Zener voltage
b. Power dissipation in zener diodes
    1. Power-temperature curves
    2. Derating factor
c. Current limitations in zener diodes
d. Effects of temperature on zener voltage
e. Temperature compensated zener diodes
f. Zener diode impedance
g. Zener diode packages

Provide Practical Application On:

a. The zener diode and its use as a voltage regulator
b. Constructing a zener diode regulator circuit

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics, Phase B
c. Zbar, Basic Electronics

Student Manuals:

a. Georgia, Electronics, Phase B, Unit 3-B
b. Heathkit, Semi-Conductor Devices
c. Zbar, Basic Electronics

Tools and Equipment:

a. Heathkit Electronic Design Experimenter ET-3100 or equivalent
b. Voltmeter with test leads
c. 47 ohm, ½-watt resistor
d. 100 ohm, ½-watt resistor
e. 220 ohm, ½-watt resistor
f. 470 ohm, ½-watt resistor
g. 1000 ohm, ½-watt resistor
h. 1N751 +10%, 500 milliwatts
i. 1000 ohm potentiometer

CLASSROOM HOURS

12

EVALUATION (ET-43)

a. Given the tools and equipment listed for this unit, the student will construct a zener diode regulator circuit incorporating a 1000 microfarad potentiometer and will measure and record diode voltage, diode current and output voltage at various resistance levels and range of output loads.

b. Test and review questions can be found in:
   1. Georgia, Electronics, Phase B, Unit 3-B.
   2. Heathkit, Semi-Conductor Devices.

TASK

ET-44 Identifying symbols and electrical characteristics of tunnel, varactor and high frequency diodes

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the electrical characteristics, construction symbols for and special applications of tunnel diodes, varactor diodes and high frequency diodes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The tunnel diode
    1. Voltage-current characteristics
    2. Negative resistance
    3. Construction and applications
    4. Tunnel diode symbols

b. The varactor diode
    1. Electrical characteristics
    2. Operating efficiency
    3. Construction and applications
    4. Varactor diode symbols

c. High frequency diodes
    1. PIN diodes
    2. IMPATT diodes
    3. Lot carrier diodes
    4. Gunn-effect diodes

Provide Demonstration On:

a. Samples of tunnel diodes, varactor diodes and high frequency diodes
b. Diode symbols

Provide Practical Application On:

a. Locating points on the V-I curve for tunnel diodes
b. Determining the quality factor (Q) for varactor diodes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics, Phase B

Student Manuals:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics, Phase B
c. Oleksy, Solid-State Electronics
d. Zbar, Basic Electronics

Tools and Equipment:

a. Basic electricity/electronics trainer
b. Variable voltage AC power supply
c. Tunnel, varactor and high frequency diodes
d. VOM

CLASSROOM HOURS

6

EVALUATION (ET-44)

a. Given the tools and equipment listed for this unit, the student will locate the peak current, valley current, peak voltage and valley voltage points on a tunnel diode's V-I curve.

b. Given a selection of special purpose diodes, the student will identify each diode by name, electrical characteristics and application.

c. Test and review questions can be found in:
   1. Heathkit, Semi-Conductor Devices.
   2. Georgia, Electronics, Phase B.

TASK

ET-45 Understanding the fundamentals of bipolar transistors and their electrical characteristics

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the operation, construction, function, symbols for and application of bipolar transistors.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. PNP and NPN transistors and their symbols
b. Transistor construction and packaging
c. Basic transistor action
    1. Biasing NPN transistors
    2. Biasing PNP transistors
d. Transistor amplification
e. Transistor circuit arrangements
    1. Common base circuits
    2. Common emitter circuits
    3. Common collector circuits

Provide Demonstration On:

a. Types of bipolar transistors
b. Typical applications of bipolar transistors

Provide Practical Application On:

Identifying types, characteristics and applications of bipolar transistors

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics, Phase B
c. Abar, Basic Electronics
d. Oleksy, Solid-State Electronics

Student Manuals:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics, Phase B

Tools and Equipment:

Various types of bipolar transistors

CLASSROOM HOURS 6

EVALUATION (ET-45)

a. When provide with various samples of bipolar transistors, the student will correctly identify each transistor by type, electrical characteristics and application.

b. Test and review questions can found in:
   1. Heathkit, Semi-Conductor Devices.
   2. Georgia, Electronics, Phase B, Units 5-B, 6-B, 7-B, 8-B and 9-B.

TASK

ET-46 Performing condition tests of bipolar transistors

PERFORMANCE OBJECTIVE

Perform condition tests of bipolar transistors using the ohmmeter, transistor curve traces and transistor tester.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Testing with an ohmmeter
b. Operating a transistor curve tracer
c. Operating a transistor tester
d. Testing bipolar transistors
    1. Test procedures
    2. Testing NPN transistors
    3. Testing PNP transistors
    4. Identifying a transistor

Provide Demonstration On:

Testing procedures

Provide Practical Application On:

a. Testing using an ohmmeter
b. Operating a transistor curve tracer
c. Operating a transistor tester

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics, Phase B

Student Manuals:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics, Phase B
c. Zbar, Basic Electronics
d. Oleksy, Solid-State Electronics

Tools and Equipment:

a. Ohmmeter with test leads
b. NPN silicon transistor MPSA20
c. PNP germanium transistor 2N2431
d. Various bipolar transistor
e. Transistor curve tracer
f. Transistor tester

CLASSROOM HOURS

12

EVALUATION (ET-46)

a. Given the tools and equipment listed for this unit, the student will correctly test the transistors with an ohmmeter to determine if they are defective.

b. Test and review questions can be found in:
   1. Heathkit, Semi-Conductor Devices.
   2. Georgia, Electronics, Phase B, Unit 5.

TASK

ET-47 Understanding the fundamentals of field effect transistors and their electrical characteristics

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the construction, operation and electrical characteristics of field effect transistors and FET circuit arrangments.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The function FET
    1. Construction
    2. Operation
    3. Gate-to-source cutoff voltage
    4. Pinch-off voltage
    5. Drain characteristic curves and transconductance
    6. Schematic symbols
b. The insulated gate FET
    1. Depletion-mode devices
    2. Enhancement-mode devices
    3. Safety precautions

(Continued on back)

Provide Practical Application On:

a. Characteristics and operation of a function FET
b. Characteristics and operation of an insulated gate FET

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics, Phase B

Student Manuals:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics, Phase B, Unit 12-B
c. Oleksy, Solid-State Electronics

Tools and Equipment:

a. Heathkit Electronic Design Experimenter ET-3100 or equivalent
b. Voltmeter with test leads
c. N-channel insulated gate FET
d. 2-1000 ohm, ½-watt resistors
e. 4700 ohm, ½-watt resistor
f. 10 K ohm, ½-watt resistor
g. 100 K ohm potentiometer
h. 1000 ohm potentiometer
i. N-channel junction FET
j. 100 ohm, ½-watt resistor

CLASSROOM HOURS

6

EVALUATION (ET-47)

a. Given the tools and equipment listed for this unit, the student will design and construct an FET circuit and calculate and measure its electrical characteristics.

b. Test and review questions can be found in:
   1. Heathkit, Semi-Conductor Devices.
   2. Georgia, Electronics, Phase B.
   3. Rutkowski, Solid-State Electronics.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

c. FET circuit arrangements
   1. Common-source circuits
   2. Common-gate circuits
   3. Common-drain circuits

TASK

ET-48 Understanding the fundamentals of thyristors and their electrical characteristics

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the electrical characteristics, construction, operation and practical applications of thyristors.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Silicon controlled rectifiers (SCR's)
   1. Construction and operation
   2. V-I characteristics
   3. Applications

b. Bidirectional triode thyristors
   1. Construction and operation
   2. V-I characteristics
   3. Applications

c. Unijunction transistors (UJT)
   1. Construction and operation
   2. V-I characteristics
   3. Applications
   4. Programmable UJT

Provide Practical Application On:

a. Operation and an application of SCR

b. Operation and an application of UJT

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, *Semi-Conductor Devices*

b. Georgia, *Electronics, Phase B*

Student Manuals:

a. Heathkit, *Semi-Conductor Devices*

b. Georgia, *Electronics, Phase B, Unit 12-B*

c. *Oleksy, Solid-State Electronics*

Tools and Equipment:

a. Heathkit Electronic Design Experimenter ET-3100 or equivalent

b. Voltmeter with test leads

c. Silicon controlled rectifier

d. Germanium diode

e. Silicon diode

f. 220 ohm, ½-watt resistor

g. 1000 ohm, ½-watt resistor

h. 4700 ohm, ½-watt resistor

i. Lamp

j. 0.1 microfarad capacitor

(Continued on back)

CLASSROOM HOURS

6

EVALUATION (ET-48)

a. Given the tools and equipment listed for this unit, the student will design, construct and demonstrate the operation of an SCR in a half-wave phase control circuit.

b. Test and review questions can be found in:
   1. Georgia, Electronics, Phase B, Unit 12-B.
   2. Heathkit, Semi-Conductor Devices.
   3. Oleksy, Solid-State Electronics.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

k. 1000 ohm potentiometer
l. 100 k ohm potentiometer
m. Unijunction transistor
n. 47 ohm, ½-watt resistor
o. 100 ohm, ½-watt resistor
p. 10 k ohm, ½-watt resistor
q. 330 k ohm, ½-watt resistor
r. 10 microfarad electrolytic capacitor
s. 1000 ohm potentiometer

TASK

ET-49 Understanding fundamentals of integrated circuits

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the characteristics, basic construction, modes of operation and applications of integrated circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Advantages and disadvantages of IC's
b. Construction types
   1. Monolithic
   2. Bipolar
   3. MOS
   4. Thin-film
   5. Thick-film
   6. Hybrids
   7. Packages
c. Applications
   1. Tri-state gate
   2. TTL open-collector gate
   3. Decade and up/down counters

(Continued on back)

Provide Demonstration On:

Examples of integrated circuits and their applications

Provide Practical Application On:

Constructing, operating and analyzing each type of IC application

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics Technology, Integrated Circuits

Student Manuals:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics Technology, Integrated Circuits, Units IC-1 through IC-11

Tools and Equipment:

a. IC breadboarding system
b. Regulator - 7805
c. Potentiometer or rheostat - 2.5K, 25 W

(Continued on back)

CLASSROOM HOURS 6

EVALUATION (ET-49)

a. Given the tools and equipment listed for this unit, the student will construct, operate and analyze each of the following applications of ICs:
   1. Tri-state gate
   2. TTL open-collector gate
   3. Decade up/down counter
   4. Multiplexes and demultiplexes
   5. Seven segment indicator and decoder
   6. Optical coupler
   7. Operational amplifier
   8. IC timer
   9. Phase-locked loop
   10. Three terminal regulator

b. Test and review questions can be found in:
   1. Heathkit, Semi-Conductor Devices.
   2. Georgia, Electronics Technology, Integrated Circuits, Student Tests.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

4. Multiplexes and demultiplexes
5. Seven segment indicators and decoders
6. Optical couplers
7. MSI applications
8. Op-amps
9. IC timers
10. Phase-locked loops
11. Three terminal regulators
12. Linear IC applications

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Oscilloscope - dual trace with DC mode
e. Sine wave generator - 0-1000 kHz with 0-10V pk-to-pk capability
f. Resistor - 4.7K ohm, 620 ohm, 3.9K, 6.8K, 1K, 100K, 10K, 300-400 ohm, 50 ohm, 1.2K, 5K, 10K, 220 ohm
g. Capacitors - 0.001 uF; 0.0047 uF; 0.1 uF; 10 uF; 0.003 uF
h. Power supply - variable voltage DC
i. Resistance decade box
j. Integrated circuit - 555
k. Miniature lamp - 8 volt
l. Diode - ECG 109
m. Switches - (2) SPST
n. Integrated circuit - uA 741; 565; 7404, 7493; 74150; 74154; 74193; 7490A; 7400, (2) 74126; (2) 7490
o. Data sheet - for uA 741 op-amp chip
p. VOM or multimeter
q. Optical coupler-motorola 4N30
r. Diode - 1N661
s. SCR - GE C20D

(Continued on next page)

EVALUATION (ET-49)

INSTRUCTIONAL MATERIALS

Tools and Equipment:

t. Transformer - 12.6V filament type
u. Digital clock
v. BCD to decimal decoder - 7447
w. Program switches
x. State indicator lights - 6
y. Clock-for 5 volt system with both manual and low frequency capability
z. LED - 1.6V; 20 mA
aa. Interconnecting leads
bb. Function generator
cc. Hand tools - Wirestripper and long-nosed pliers

TASK

ET-50 Defining the operating values and applications of optoelectronic devices

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the principles of operation and the practical applications of optoelectronic devices.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Characteristics of light
b. Systems of light measurement
  1. Radiometric
  2. Photometric
c. Light sensitive devices
  1. Photoconductive cells
  2. Photovoltanic cells
  3. Photodiodes
  4. Phototransistors
d. Light emitting devices
  1. Operation and construction
  2. Electrical characteristics
  3. Applications

Provide Practical Application On:

a. Operation of a phototransistor
b. Operation of an LED

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics Technology, Integrated Circuits

Student Manuals:

a. Heathkit, Semi-Conductor Devices
b. Georgia, Electronics Technology, Integrated Circuits

Tools and Equipment:

a. Heathkit Electronic Design Experimenter ET-3100 or equivalent
b. Volt-ohm meter with test leads
c. Phototransistor
d. Lamp
e. 10 k ohm, 1/2-watt
f. 1000 k ohm potentiometer (built into ET-3100)
g. LED
h. 1000 k ohm, 1/2-watt

CLASSROOM HOURS 6

EVALUATION (ET-50)

a. Given the tools and equipment listed for this unit, the student will demonstrate the operation of:
   1. A phototransistor
   2. A light-emitting diode.

b. Test and review questions can be found in:
   1. Heathkit, Semi-Conductor Devices.
   2. Georgia, Electronics Technology, Integrated Circuits, Student Tests.

TASK

ET-51 Identifying the component parts and operational characteristics of diode vacuum tubes

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the characteristics and operation of diode vacuum tubes and the ability to identify the parts of a diode vacuum tube.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Construction of diode vacuum tubes
b. Thermionic emission
c. Cathode construction
d. Filament current
e. The vacuum
f. Diode rectifier circuits
    1. Load resistance
    2. Half-wave rectifier
    3. Ripple frequency
    4. DC polarity
    5. The diode as a one-way switch
g. Schematic symbol

Provide Demonstration On:

a. Various types of diode vacuum tubes
b. Diode vacuum tube applications

Provide Practical Application On:

Operation and dynamic characteristics of diode vacuum tubes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, *Basic Electronics*
b. Manufacturer's tube manual
c. Georgia, *Electronics, Phase B*
d. Training and Retraining, Inc., *Basic Electricity/Electronics*

Student Manuals:

Georgia, *Electronics, Phase B*, Unit 13-B

Tools and Equipment:

a. Variable power supply panel
b. Vacuum tube characteristics panel
c. Multimeter
d. Oscilloscope
e. Linear graph paper
f. 100,000 ohm, 1-watt resistor
g. 22,000 ohm, 1-watt resistor
h. Vacuum tube, type 6AL5
i. Diode schematic overlay

CLASSROOM HOURS 6

EVALUATION (ET-51)

a. Given the tools and equipment listed for this unit, the student will demonstrate the operation and operational characteristics of diode vacuum tubes.

b. Test and review questions can be found in:
   1. Grob, Basic Electronics.
   2. Georgia, Electronics, Phase B, Unit 13-B.
   3. Training and Retraining, Inc., Basic Electricity/Electronics.

TASK

ET-52 Identifying the component parts and operating characteristics of triode vacuum tubes

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the characteristics and operation of triode vacuum tubes and the ability to identify the parts of a triode vacuum tube.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Triode construction
b. C-voltage
c. Grid cutoff voltage
d. Triode circuit
e. Control-grid bias
f. Symbols for tube voltages
g. How a triode amplifies the control grid voltage
  1. Phase inversion
  2. Voltage gain
h. Triode characteristic values of grid voltage
i. Tube parameters
  1. Amplification factor
  2. Plate resistance
  3. Transconductance

(Continued on back)

Provide Demonstration On:

a. Various types of triode vacuum tubes
b. Triode vacuum tube application

Provide Practical Application On:

a. Static characteristics of triode vacuum tubes
b. Producing triode vacuum tube bias
c. The triode vacuum tube as an amplifier

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Manufacturer's tube manual
c. Georgia, Electronics, Phase B
d. Training and Retraining, Inc., Basic Electricity/Electronics

Student Manuals:

Georgia, Electronics, Phase B, Units 13-B and 14-B

Tools and Equipment:

a. Typical triode static characteristics curves
b. Linear graph paper
c. Variable power supply panel
d. Vacuum tube characteristics panel
e. Vacuum tube, type 6J5
f. Triode schematic overlay
g. Vacuum-tube voltmeter
h. Audio-frequency signal generator

(Continued on back)

CLASSROOM HOURS

6

EVALUATION (ET-52)

a. Given the tools and equipment listed for this unit, the student will demonstrate the operation and operational characteristics of triode vacuum tubes.

b. Test and review questions can be found in:
   1. Grob, Basic Electronics.
   2. Georgia, Electronics, Phase B, Units 13-B and 14-B.
   3. Training and Retraining, Inc., Basic Electricity/Electronics.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

j. Tube manuals
k. Biasing
l. Interelectrode capacitance
m. Feedback voltage

INSTRUCTIONAL MATERIALS

Tools and Equipment:

i. Oscilloscope
j. 1 megohm, 1-watt resistor
k. 470,000 ohm, 1-watt resistor
l. 5100 ohm, 7-watt resistor
m. 1000 ohm, 1-watt resistor
n. .1 microfarad capacitor
o. .2 microfarad capacitor
p. 47,000 ohm 1-watt resistor
q. 2200 ohm, 1-watt resistor

TASK

ET-53 Identifying the component parts and operating characteristics of tetrode vacuum tubes

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the characteristics and operation of a tetrode vacuum tube and the ability to identify the parts of a tetrode vacuum tube.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Tetrode tube construction
   1. Feedback reduction
   2. The screen grid
b. Screen-grid voltage
c. Screen bypass capacitor
d. Grid plate capacitance
e. Secondary emission

Provide Demonstration On:

a. Types of tetrode vacuum tubes
b. Tetrode vacuum tube applications

Provide Practical Application On:

Operation and static characteristics of tetrode vacuum tubes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Manufacturer's tube manual
c. Training and Retraining, Inc., Basic Electricity/ Electronics

Tools and Equipment:

a. Variable power supply panel
b. Vacuum tube characteristics panel
c. Linear graph paper
d. Vacuum tube, type 6SJ7
e. 1000 ohm, 5-watt resistor
f. 27 ohm, 1-watt resistor
g. Vacuum-tube voltmeter

CLASSROOM HOURS

6

EVALUATION (ET-53)

a. Given the tools and equipment listed for this unit, the student will demonstrate the operation and operational characteristics of tetrode vacuum tubes.

b. Test and review questions can be found in:
   1. Grob, Basic Electronics.
   2. Training and Retraining, Inc., Basic Electricity/Electronics.

TASK

ET-54 Identifying the component parts and operating characteristics of pentode vacuum tubes

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the characteristics and operation of pentode vacuum tubes and the ability to identify the parts of a pentode vacuum tube.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Pentode tube construction
b. Pentode vacuum tube characteristics
c. Current paths
d. Remote cutoff pentodes
e. High frequency operation
f. Secondary emission
g. Suppressor grid

Provide Demonstration On:

a. Types of pentode tubes
b. Pentode tube application

Provide Practical Application On:

Operation and static characteristics of a pentode vacuum tube

INSTRUCTIONAL MATERIALS

Textbooks:

a. Grob, Basic Electronics
b. Manufacturer's tube manual
c. Training and Retraining, Inc., Basic Electricity/Electronics

Tools and Equipment:

a. Variable power supply panel
b. Vacuum tube characteristics panel
c. Linear graph paper
d. Vacuum tube, type 6SJ7
e. 1000 ohm, 5-watt resistor
f. 27 ohm, 1-watt resistor

CLASSROOM HOURS	6

EVALUATION (ET-54)

a. Given the tools and equipment listed for this unit, the student will demonstrate the operation and operational characteristics of pentode vacuum tubes.

b. Test and review questions can be found in:
   1. Grob, Basic Electronics.
   2. Training and Retraining, Inc., Basic Electricity/Electronics.

TASK

ET-55 Performing condition testing of the thermal stability and operational parameters of a common-emitter amplifier circuit

PERFORMANCE OBJECTIVE

Determine the thermal stability and operational parameters of a common-emitter amplifier circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Function and types of amplifiers
b. Amplifier configurations
   1. Common-emitter circuits
   2. Common-base circuits
   3. Common-collector circuits
c. Amplifier biasing
   1. Base-biased circuits
   2. Feedback bias
   3. Voltage-divider biasing
   4. Class of operation
d. Amplifier coupling
   1. Resistance-capacitance coupling

(Continued on back)

Provide Demonstration On:

a. Thermal stability of basic amplifier circuits
b. Operation and characteristics of a common-emitter amplifier circuit

Provide Practical Application On:

Have learner construct:
a. A basic amplifier circuit and demonstrate the relative thermal stability
b. A common-emitter amplifier and determine
   1. Voltage gain with and without a bypass capacitor

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, Electronic Circuits
b. Grob, Basic Electronics
c. Shrader, Electronic Communications

Student Manuals:

a. Heathkit, Electronic Circuits, Student Workbook
b. Georgia, Electronics Phase B

Tools and Equipment:

a. Heathkit Electronic Design Experimenter (ET-3100 or equivalent)
b. Voltmeter
c. NPN transistor

CLASSROOM HOURS

12

EVALUATION (ET-55)

a. Given a common-emitter amplifier circuit and the necessary supplies and equipment, the student will determine the thermal stability and operational parameter of the circuit. Test results must be within specifications established by the instructor.

b. Test and review questions can be found in:
   1. Heathkit, Electronic Circuits, Student Workbook.
   2. Georgia, Electronics, Phase B.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

2. Impedance coupling
3. Direct coupling
4. Transformer coupling

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. 2.2 kilohm, 1/2-watt resistor
e. 4.7 kilohm, 1/2-watt resistor
f. Two 10 kilohm, 1/2-watt resistor
g. 22 kilohm, 1/2-watt resistor
h. 470 kilohm, 1/2-watt resistor
i. 1.5 megohm potentiometer
j. Multimeter with leads
k. Oscilloscope
l. 1 kilohm, 1/2-watt resistor
m. 56 kilohm, 1/2-watt resistor
n. Three 33 microfarad tantalum capacitors
o. 1 kilohm potentiometer (built into ET-3100)
p. 100 kilohm potentiometer (built into ET-3100)

TASK

ET-56 Performing condition testing of DC and audio amplifiers

PERFORMANCE OBJECTIVE

Determine the condition of DC and audio amplifiers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Direct current amplifiers
    1. Multiple-stage amplifiers
    2. Darlington amplifiers
    3. Differential amplifiers
b. Audio amplifiers
    1. Voltage amplifiers
    2. Power amplifiers
    3. Single-ended power amplifiers
    4. Push-pull power amplifiers
    5. Complementary amplifiers

(Continued on back)

Provide Demonstration On:

a. The DC amplifier
b. Distortion in a complementary power amplifier

Provide Practical Application On:

Condition testing of DC and audio amplifiers

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, Electronic Circuits
b. Grob, Basic Electronics
c. Shrader, Electronic Communications

Student Manuals:

a. Heathkit, Electronic Circuits, Student Workbook
b. Georgia, Electronics, Phase B

Tools and Equipment:

a. Heathkit Experimenter (ET-3100 or equivalent)
b. Multimeter with leads
c. Calibrated oscilloscope with leads

(Continued on back)

CLASSROOM HOURS

12

EVALUATION (ET-56)

a. Given DC and audio amplifiers and the necessary supplies and equipment, the student will determine the condition of the amplifiers. Test results must be within specifications established by the instructor.

b. Test and review questions can be found in:
   1. Heathkit, Electronic Circuits, Student Workbook, Unit 2.
   2. Georgia, Electronics, Phase B.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

6. Quasi-complementary amplifiers
7. Heat sinks
8. Volume control circuits
9. Tone control circuits

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. 4.7 ohm, 1/2-watt resistor
e. Two 100 ohm, 1/2-watt resistor
f. Two 330 ohm, 1/2-watt resistor
g. 4700 ohm, 1/2-watt resistor
h. 8200 ohm, 1/2-watt resistor
i. 10 kilohm, 1/2-watt resistor
j. 47 kilohm, 1/2-watt resistor
k. 10 microfarad tantalum capacitor
l. 33 microfarad electrolytic capacitor
m. 250 microfarad electrolytic capacitor
n. 100 microfarad electrolytic capacitor
o. 0.1 microfarad Mylar
p. Stabistor
q. Two NPN transistors
r. PNP transistor
s. Loudspeaker
t. One kilohm potentiometer (built into ET-3100)
u. One kilohm potentiometer (built into ET-3100)
v. Two 1000 ohm, 1/2-watt resistors
w. 100 kilohm, 1/2-watt resistor
x. 100 pF capacitor
y. 1000 pF (.001 microfarad) capacitor
z. Silicon diode
aa. Darlington transistor

TASK

ET-57 Defining electrical characteristics, applications and normal operational values of amplifiers

PERFORMANCE OBJECTIVE

Determine electrical characteristics, applications and normal operational values of amplifiers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Differential amplifiers
    1. Basic differential amplifiers circuits
    2. Single-input, single output operation
    3. Single input, differential-output circuit
    4. Differential-input, differential-output operation
    5. Current sources and voltage sources
    6. Practical current
    7. Practical differential amplifiers

(Continued on back)

Provide Demonstration On:

Operational amplifiers

Provide Practical Application On:

Determining:
a. Characteristics of differential amplifiers
b. Characteristics of the operational amplifier and its use as a comparator
c. Characteristics of inventing and noninverting amplifiers
d. Characteristics of active filters

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, Electronic Circuits
b. Grob, Basic Electronics
c. Schrader, Electronic Communication

Student Manuals:

a. Heathkit, Electronic Circuits, Student Workbook
b. Georgia, Electronics, Phase B

Tools and Equipment:

a. Heathkit Experimenter (ET-3100 or equivalent)
b. Multimeter with leads
c. Oscilloscope with probe

(Continued on back)

CLASSROOM HOURS

6

EVALUATION (ET-57)

a. Given amplifier(s) and the necessary supplies and equipment, the student will determine the electrical characteristics, applications and normal operational values of the amplifier. The test results must be within the limits of the actual values of the amplifier and the applications must be identified.

b. Test and review questions can be found in:
   1. Heathkit, Electronic Circuits, Student Workbook, Unit 2.
   2. Georgia, Electronics, Phase B.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

   8. Common-mode input operation
   9. Differential-input operation
   10. Common-mode rejection ratio
   11. 1 C differential amplifiers

b. Operational amplifier characteristics
c. L C operational amplifier families
d. Closed-loop operation
   1. Inverting configuration
   2. Noninverting configuration
   3. Bandwidth limitations
   4. Operational amplifier circuits
e. Applications of operational amplifiers
   1. Summing amplifier (adder)
   2. Active filters
   3. Difference amplifiers

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. 100 k ohm, potentiometer (built into ET-3100)
e. 10 ohm, 1/2-watt resistor
f. Three NPN transistors
g. Two 4.7 k ohm, 1/2-watt resistor
h. Two 10 k ohm, 1/2-watt resistor
i. 2.2 k ohm, 1/2-watt resistor
j. 33 k ohm, 1/2-watt resistor
k. 47 k ohm, 1/2-watt resistor
l. Three 1 k ohm, 1/2-watt resistors
m. Two 100 ohm, 1/2-watt resistors
n. 200 ohm, potentiometer
o. Audio transformer
p. 10 microfarad electrolytic capacitor
q. 1 k ohm potentiometer (built into ET-3100)
r. Hook-up wire
s. Soldering iron
t. 741 C operational amplifier
u. Two 100 k ohm, 1/2-watt resistors
v. Three 0.0022 microfarad capacitors
w. 8.2 k ohm, 1/2-watt resistor

TASK

ET-58 Testing an amplifier for amplification

PERFORMANCE OBJECTIVE

Test and determine the amplification gain of an amplifier.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Amplifier operation and theory
b. Test equipment hook-up for testing
c. Gain measurement test

Provide Demonstration On:

a. How to set up an amplifier to perform gain test
b. How to collect data from gain test
c. How to plot an amplifier amplitude to frequency gain characteristic

Provide Practical Application On:

Have learner:
a. Practice testing amplifiers for gain characteristics and collecting data that can be used to plot the amplifiers gain parameters.
b. Plot the gain characteristics of the amplifiers.

INSTRUCTIONAL MATERIALS

Textbooks:

Wells, Audio Servicing: Theory and Practice

Student Manuals:

a. Wells, Audio Servicing: A Text-Lab Manual
b. Georgia, Electronics, Phase B

Tools and Equipment:

a. Amplifiers
b. Voltmeter
c. Oscilloscope
d. Audio meter
e. Graph paper

CLASSROOM HOURS 6

EVALUATION (ET-58)

Given an amplifier and the necessary supplies and equipment, the student will test, collect data and plot the gain of the amplifier. The data must be plotted on graph paper so that an overall picture of the characteristics (amplitude to frequency response) can be seen. The characteristics must be within the operational parameter of the amplifier.

TASK

ET-59 Testing and repairing the vacuum tube amplifier

PERFORMANCE OBJECTIVE

Perform an operational check on a standard vacuum tube amplifier and repair any malfunction that may exist.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Normal operating procedure of the vacuum tube amplifier
b. Troubleshooting steps
c. Standard repair procedures

Provide Demonstration On:

a. Testing the amplifier for normal performance
b. Some abnormal operating conditions of the amplifier
c. The standard method to troubleshoot the amplifier

Provide Practical Application On:

Have learner:
a. Practice checking out vacuum tube amplifiers for normal operation.
b. Demonstrate how to correct malfunctions in the vacuum tube amplifier.

INSTRUCTIONAL MATERIALS

Student Manuals:

Prentice-Hall, Troubleshooting: A Self-Instructional Programmed Manual

Tools and Equipment:

a. Vacuum tube amplifier
b. Test equipment
c. Schematic and manual
d. Screwdrivers, blade, assorted
e. Screwdrivers, Phillips head, assorted
f. Wrenches, adjustable
g. Iron, soldering
h. Solder, resin core
i. Pliers, needle nose
j. Pliers, diagonal
k. Flashlight

CLASSROOM HOURS 6

EVALUATION (ET-59)

Given a vacuum tube amplifier, the schematic and the necessary tools and test equipment, the student will test the amplifier for normal and abnormal operation. Malfunctions must be corrected so that the amplifier performs to the standards of the specification manual.

TASK

ET-60 Testing and repairing a transistor amplifier

PERFORMANCE OBJECTIVE

Perform an operational check on a standard transistor amplifier and repair any malfunction that may exist.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Normal operating conditions of the transistor amplifier
b. Troubleshooting a standard transistor amplifier
c. Basic repair procedures

Provide Demonstration On:

a. Testing the transistor amplifier for normal operation
b. Some abnormal operating conditions of a transistor amplifier
c. Standard method to troubleshoot the amplifier

Provide Practical Application On:

Have learner:
a. Practice checking out the operation of some transistor amplifiers.
b. Demonstrate how to troubleshoot the amplifier for different types of malfunctions.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Lenk, Handbook of Practical Solid State Troubleshooting
b. Lenk, Handbook of Modern Solid State Amplifiers

Student Manuals:

Prentice-Hall, Electronic Troubleshooting: A Self-Instructional Programmed Manual

Tools and Equipment:

a. Transistor amplifier
b. Test equipment
c. Schematic and manual
d. Screwdrivers, blade, assorted

(Continued on back)

CLASSROOM HOURS

12

EVALUATION (ET-60)

Given a transistor amplifier, the schematic and the necessary tools and test equipment, the student will test the amplifier for normal and abnormal operation. Malfunctions must be corrected so that the amplifier performs to the standards of the specification manual.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

e. Screwdrivers, Phillips head, assorted
f. Wrenches, adjustable
g. Iron, soldering
h. Solder, resin core
i. Pliers, needle nose
j. Pliers, diagonal
k. Flashlight

TASK

ET-61 Identifying component parts and electrical characteristics of power supply circuits

PERFORMANCE OBJECTIVE

Identify the component parts and electrical characteristics of a power supply circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Rectifier circuits
   1. Half-wave rectifiers
   2. Full-wave rectifiers
   3. Bridge rectifiers
b. Power supply filters
   1. The capacitor as a filter
   2. Percent ripple
   3. RC filters
   4. LC filters
c. Voltage multipliers
   1. Half-wave voltage double
   2. Full-wave voltage double
   3. Voltage tripler
d. Voltage regulation
   1. Load regulation

(Continued on back)

Provide Demonstration On:

a. Unregulated power supplies
b. Operation and characteristics of the shunt regulator and the series regulator

Provide Practical Application On:

Have learner:
a. Construct a power supply circuit using a kit.
b. Identify the component parts and electrical characteristics of the power supply circuit.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, Electronic Circuits
b. Grob, Basic Electronics

Student Manuals:

a. Heathkit, Electronic Circuits, Student Workbook
b. Georgia, Electronics, Phase B

Tools and Equipment:

a. Heathkit Experimenter (ET-3100 or equivalent)
b. Oscilloscope with leads
c. Voltmeter with leads
d. Silicon diodes

(Continued on back)

CLASSROOM HOURS 8

EVALUATION (ET-61)

a. Given a power supply circuit and the necessary supplies and equipment, the student will identify the component parts and electrical characteristics of the circuit. Component parts must be correctly identified. The electrical characteristics of the circuit must be identified.

b. Test and review questions can be found in:
   1. Heathkit, Electronic Circuits, Student Workbook.
   2. Georgia, Electronics, Phase B.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

   2. The zener regulator

e. Series voltage regulator
   1. The emitter follower regulator
   2. The feedback regulator
   3. The feedback regulator with operational amplifier
   4. Short circuit protection

f. Power supply circuits
   1. Overload protection devices
   2. Protective circuits
   3. Shunt regulators
   4. 1 C regulators
   5. Oscilloscope power supply
   6. Color TV power supply
   7. ET-3100 power supply

INSTRUCTIONAL MATERIALS

Tools and Equipment:

e. 10 microfarad, 70 volt, electrolytic capacitor
f. 100 microfarad, 50 volt, electrolytic capacitor
g. 5600 ohm, 1/2-watt resistor
h. 22 k ohm, 1/2-watt resistor
i. Silicon transistor (417-818)
j. Three silicon transistors (417-801)
k. 2.7 V zener diode
l. 6.2 V zener diode
m. 721C operational amplifier
n. Two silicon diodes (57-27)
o. 10 ohm, 1/2-watt resistor
p. 100 ohm, 1/2-watt resistor
q. 150 ohm, 1/2-watt resistor
r. 220 ohm, 1/2-watt resistor
s. 330 ohm, 1/2-watt resistor
t. 620 ohm, 1/2-watt resistor
u. Three 1000 ohm, 1/2-watt resistors
v. 1800 ohm, 1/2-watt resistor
w. 47 k ohm, 1/2-watt resistor
x. One k ohm potentiometer (built into ET-3100)
y. 100 k ohm potentiometer (built into ET-3100)

TASK

ET-62 Testing and repairing power supplies

PERFORMANCE OBJECTIVE

Perform an operational check on a power supply and repair any malfunction that may exist.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Standard operation of the power supply
b. Voltage specifications
c. Types of malfunctions
d. Types of test equipment to be used to locate trouble
e. Correcting malfunctions

Provide Demonstration On:

a. How to check the different voltages in the power supply
b. How the power supply electrically operates
c. The steps used to locate malfunctions in the power supply

Provide Practical Application On:

Have learner:
a. Operate a good power supply and check voltages of the normal power supply.
b. Explain how to troubleshoot the circuit if abnormal voltages exist.

INSTRUCTIONAL MATERIALS

Textbooks:

Grob, Basic Electronics

A/Vs:

Films from the USAF

Student Manuals:

Prentice-Hall, Electronic Troubleshooting: A Self-Instructional Programmed Manual

Tools and Equipment:

a. Power supplies, good and bad
b. Oscilloscope
c. VTVM
d. Schematic
e. Operation manual
f. Screwdrivers, blade assorted

(Continued on back)

CLASSROOM HOURS

6

EVALUATION (ET-62)

Given a power supply, schematic and the necessary tools and equipment, the student will check a power supply for correct operation and correct any malfunction. Malfunctions must be corrected so that the level of power conforms to the manufacture's specifications.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

g. Screwdrivers, Phillips head, assorted
h. Wrenches, adjustable
i. Iron, soldering
j. Solder, resin core
k. Pliers, needle nose
l. Pliers, diagonal
m. Flashlight

TASK

ET-63 Calibrating power supply voltage

PERFORMANCE OBJECTIVE

Use the calibration procedure for a power supply as a method of troubleshooting a voltage malfunction within the power supply.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Normal calibration procedures
b. Troubleshooting steps
c. Troubleshooting-locating the area of trouble
d. Troubleshooting to the component level

Provide Demonstration On:

a. Normal calibration
b. Recognizing an abnormal power supply
c. Using visual, test, area isolation and component level techniques to troubleshoot

Provide Practical Application On:

Have learner:
a. Practice calibrating some good power supplies.
b. Calibrate power supplies with defective outputs.
c. Write a conclusion about what he/she believes is the problem

INSTRUCTIONAL MATERIALS

Textbooks:

Lemons, Learn Electronics Through Troubleshooting

Student Manuals:

Prentice Hall, Electronic Troubleshooting: A Self-Instructional Programmed Manual

Tools and Equipment:

a. Power supplies, good and bad
b. Oscilloscope
c. VTVM
d. Screwdrivers, blade, assorted
e. Screwdrivers, Phillips head, assorted
f. Wrenches, adjustable
g. Iron, soldering
h. Solder, resin core
i. Pliers, needle nose
j. Pliers, diagonal
k. Flashlight

CLASSROOM HOURS 6

EVALUATION (ET-63)

Given a power supply and the necessary tools and equipment, the student will calibrate the power supply and troubleshoot the power supply by using the calibration procedure. The power supply must be calibrated or, if not, the problem must be identified in writing.

TASK

ET-64 Constructing oscillators and performing a condition test of the oscillators

PERFORMANCE OBJECTIVE

Construct an oscillator and perform a condition test of the oscillators.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Characteristics of a basic oscillator
b. Transformer oscillators
    1. Tuned-collector oscillators
    2. Tuned-base oscillators
c. LC oscillators
    1. The series-fed Hartley oscillator
    2. The shunt-fed Hartley oscillator
    3. Crystal Colpitts, and Clapp oscillator
d. Controlled oscillators
    1. Equivalent crystal circuits

(Continued on back)

Provide Demonstration On:

a. The practical tank circuit
b. LC oscillators (Colpitts and Hartley)
c. Crystal oscillators (Colpitts and Pierce)
d. The Wien-bridge oscillator

Provide Practical Application On:

Have learner:
a. Construct an oscillator using a kit.
b. Perform condition tests until the master procedure.

INSTRUCTIONAL MATERIALS

Textbooks:

Heathkit, Electronic Circuits

Student Manuals:

a. Heathkit, Electronic Circuits, Student Workbook
b. Georgia, Electronics, Phase C

Tools and Equipment:

a. Experimenter
b. Oscilloscope with leads
c. VOM (Heathkit IM-17 or equivalent)
d. 47 microhenry
e. NPN transistor

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CLASSROOM HOURS

12

EVALUATION (ET-64)

a. Given the necessary instructions, supplies and equipment, the student will construct an oscillator and perform a condition test of the oscillator. The oscillator must operate according to specifications.

b. Test and review questions can be found in:
   1. Heathkit, Electronic Circuits.
   2. Georgia, Electronics, Phase C.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

   2. The Hartley Crystal oscillator
   3. The Colpitts Crystal oscillator
   4. The Pierce oscillator
   5. The Butler oscillator

e. RC oscillators
   1. The phase-shift oscillator
   2. The Wein-bridge oscillator

f. Nonsinusoidal oscillators
   1. The blocking oscillator
   2. A sawtooth blocking oscillator

g. High frequency oscillators

INSTRUCTIONAL MATERIALS

Tools and Equipment:

f. 3579.545 kilohertz crystal
g. 4.7 pF capacitor .
h. 24 pF capacitor
i. 47 pF capacitor
j. Two .01 microfarad capacitors
k. Two .001 microfarad capacitors
l. 560 ohm, 1/2-watt resistor
m. 1500 ohm, 1/2-watt resistor
n. 8200 ohm, 1/2-watt resistor
o. Two 10 k ohm, 1/2-watt resistor
p. 47 k ohm, 1/2-watt resistor
q. Two 100 k ohm, 1/2-watt resistor
r. Two 1 M ohm, 1/2-watt resistor
s. 305 microhertz inductor
t. Two .1 microfarad capacitors
u. 22 k ohm, 1/2-watt resistor
v. 4.7 ohm, 1/2-watt resistor
w. Two 100 pF capacitors
x. 470 pF capacitor
y. 741 C operational amplifier
z. Incandescent lamp

EVALUATION (ET-64)

INSTRUCTIONAL MATERIALS

Tools and Equipment:

aa. 220 ohm, ½-watt resistor
bb. One k ohm potentiometer
    (built into ET-3100)
cc. 30-watt soldering iron

TASK

ET-65 Testing and repairing oscillators

PERFORMANCE OBJECTIVE

Perform an operational check on an oscillator and repair any defeceive circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Oscillator operation and theory
b. Types of oscillators
c. Methods of testing oscillators
d. Methods of calibration

Provide Demonstration On:

a. How the oscillator works
b. Some abnormal symptoms
c. Some common defects
d. Basic repair techniques

Provide Practical Application On:

Have learner:
a. Test and calibrate several oscillator circuits.
b. Troubleshoot and repair defective oscillator circuits.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Shrader, Electronic Communication
b. Horowitz and Hill, The Art of Electronics
c. Heathkit, Electronic Circuits

Student Manuals:

a. Heathkit, Electronic Circuits, Student Workbook
b. Georgia, Electronics, Phase C

Tools and Equipment:

a. Oscillator circuit
b. Oscilloscope
c. VOM
d. Schematic
e. Screwdrivers, blade, assorted

(Continued on back)

CLASSROOM HOURS

12

EVALUATION (ET-65)

Given both good and defective oscillator circuits, schematics and the necessary tools and equipment, the student will identify the defective circuits and make the necessary repair(s). The repaired circuits must operate according to specifications.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

f. Screwdrivers, Phillips head, assorted
g. Wrenches, adjustable
h. Iron, soldering
i. Solder, resin core
j. Pliers, needle nose
k. Pliers, diagonal
l. Flashlight

TASK

ET-66 Testing and repairing clampers

PERFORMANCE OBJECTIVE

Perform an operational check on a clamper circuit and repair any malfunction that may exist.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Clamper theory and operation
b. Troubleshooting the clamper with test equipment

Provide Demonstration On:

a. Testing the clamper circuit
b. Some abnormal operating conditions of the clamper
c. How to troubleshoot and repair the clamper

Provide Practical Application On:

Have learner:
a. Test the clamper circuit and identify the defective circuits.
b. Repair any defect and retest the clamper circuit.

INSTRUCTIONAL MATERIALS

Textbooks:

McGraw-Hill, *A Programmed Course in Basic Pulse Circuits*

Tools and Equipment:

a. Clamper circuit
b. Voltmeter
c. Oscilloscope
d. Schematic
e. Screwdrivers, blade, assorted
f. Screwdrivers, Phillips head, assorted
g. Wrenches, adjustable
h. Iron, soldering
i. Solder, resin core
j. Pliers, needle nose
k. Pliers, diagonal
l. Flashlight

CLASSROOM HOURS

6

EVALUATION (ET-66)

Given a clamper circuit, schematic and the necessary tools and equipment, the student will perform an operational check on the circuit and repair any malfunction(s). The repaired circuit must meet the specified standards of operation.

TASK

ET-67 Testing and repairing clipper circuits

PERFORMANCE OBJECTIVE

Perform an operational check on a clipper circuit and repair any malfunction that may exist.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Clipper circuit theory and operation
b. Troubleshooting the clipper test equipment
c. Basic repair techniques of the clipper

Provide Demonstration On:

a. Testing the clipper circuit for correct operation
b. Some abnormal operating conditions of a clipper circuit
c. How to troubleshoot and repair the clipper circuit

Provide Practical Application On:

Have learner:
a. Test clipper circuits and identify the defective circuits.
b. Repair any defects and retest the clipper circuit.

INSTRUCTIONAL MATERIALS

Textbooks:

McGraw-Hill, A Programmed Course in Basic Pulse Circuits

Tools and Equipment:

a. Clipper circuit
b. Oscilloscope
c. Voltmeter
d. Schematic
e. Screwdrivers, blade, assorted
f. Screwdrivers, Phillips head, assorted
g. Wrenches, adjustable
h. Iron, soldering
i. Solder, resin core
j. Pliers, needle nose
k. Pliers, diagonal
l. Flashlight

CLASSROOM HOURS

6

EVALUATION (ET-67)

Given a clipper circuit, schematic and the necessary tools and equipment, the student will perform an operational check on the circuit and repair any malfunction(s). The repaired circuit must meet the specified standards of operation.

TASK

ET-68 Testing and repairing counters

PERFORMANCE OBJECTIVE

Perform an operational check on a counter circuit and repair any malfunction that may exist.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Counter theory and operation
b. Troubleshooting the counter with test equipment
c. Basic repair techniques of the counter

Provide Demonstration On:

a. How to test the counter circuit
b. Some abnormal operating conditions of the counter
c. How to troubleshoot and repair the counter

Provide Practical Application On:

Have learner:
a. Test the counter circuits and identify the defective circuits
b. Repair any defects and retest the counter circuits

INSTRUCTIONAL MATERIALS

Textbooks:

a. Triebel, Integrated Digital Electronics
b. Tokheim, Digital Electronics
c. Heathkit, Digital Techniques

Tools and Equipment:

a. Counter circuit
b. Voltmeter
c. Digital probe
d. Oscilloscope
e. Schematic
f. Screwdrivers, blade, assorted
g. Screwdrivers, Phillips head, assorted
h. Wrenches, adjustable
i. Iron, soldering

(Continued on back)

CLASSROOM HOURS 12

EVALUATION (ET-68)

Given a counter circuit, schematic and the necessary tools and equipment, the student will perform an operational check on the circuit and repair any malfunction(s). The repaired circuit must meet the specified standards of operation.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

j. Solder, resin core
k. Pliers, needle nose
l. Pliers, diagonal
m. Flashlight

TASK

ET-69 Constructing and performing condition tests of pulse circuits

PERFORMANCE OBJECTIVE

Construct a pulse circuit and perform a condition test of the circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Nonsinusoidal wave forms
    1. Frequency domain analysis
    2. Wave form spectrum
b. Wave shaping
    1. RC wave shaping by differentiator
    2. RC waveshaping by integrator
    3. Types of diode clipping circuits
    4. Transistor clippers
    5. Clampers
c. Rectangular wave generators
    1. Astable multivibrator
    2. Monostable multivibrator

(Continued on back)

Provide Demonstration On:

a. Wave shaping
b. Operation and characteristics of various rectangular-wave generators
c. Ramp generators

Provide Practical Application On:

Have learner construct a pulse circuit and perform a condition test of the circuit.

INSTRUCTIONAL MATERIALS

Textbooks:

Heathkit, *Electronic Circuits*

Student Manuals:

Heathkit, *Electronic Circuits, Student Workbook*

Tools and Equipment:

a. Heathkit, Experimenter (ET-3100 or equivalent)
b. Oscilloscope with leads
c. Multimeter with leads
d. Two NPN silicon transistors
e. Two silicon diodes
f. "555 Timer" 1C
g. 100 ohm 1/2-watt resistor
h. Three 1000 ohm, 1/2 watt resistors
i. 1500 ohm, 1/2 watt resistor

(Continued on back)

CLASSROOM HOURS

12

EVALUATION (ET-69)

a. Given the necessary instructions, supplies and equipment, the student will construct a pulse circuit and perform a condition test of the circuit. The pulse circuit must operate according to specifications.

b. Test and review questions may be found in: Heathkit, Electronics Circuits, Student Workbook.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

3. Bistable multivibrator
4. Schmitt trigger
5. The 555 timer

d. Ramp generators
   1. Forming the ramp
   2. Operational amplifier
   3. Sawtooth generator

INSTRUCTIONAL MATERIALS

Tools and Equipment:

j. Two 3300 ohm, 1/2-watt resistors
k. Two 10 k ohm, 1/2-watt resistors
l. Two 0.1 microfarad capacitors
m. Two 0.01 microfarad capacitors
n. 0.001 microfarad capacitor
o. 0.039 microfarad capacitor
p. 0.02 microfarad capacitor
q. 100 k ohm potentiometer (built into ET-3100)
r. 4700 ohm, 1/2-watt resistor
s. 22 k ohm, 1/2-watt resistor
t. One M ohm, 1/2-watt resistor
u. Silicon transistor
v. Silicon diode
w. 2.7 V zener diode
x. 6.2 V zener diode
y. 741 C operational amplifier
z. PNP transistor
aa. .68 microfarad capacitor
bb. .0022 microfarad capacitor
cc. 100 k ohm potentiometer (built into ET-3100)
dd. One k ohm potentiometer (built into ET-3100)
ee. Oscilloscope with probes
ff. .001 microfarad ceramic capacitor
gg. .1 microfarad Mylar capacitor

TASK

ET-70 Testing and repairing nonsinusoidal amplifiers

PERFORMANCE OBJECTIVE

Perform an operational check on a nonsinusoidal wave shaping amplifier and repair any defect in the amplifier.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Wave shaping circuit operation
b. Theory of wave shaper circuits
c. Discrete and IC wave shaper circuits
d. Method of troubleshooting

Provide Demonstration On:

a. How to test the wave shaping circuit
b. Normal malfunctions of wave shaper circuit
c. How to troubleshoot
d. How to repair

Provide Practical Application On:

a. Inspect and test good wave shaper circuits.
b. Troubleshoot and repair wave shaper circuit.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Heathkit, *Active Filters*
b. Heathkit, *IC Timers*
c. Heathkit, *Electronic Circuits*
d. Horowitz and Hill, *The Art of Electronics*

Student Manuals:

Heathkit, *Electronic Circuits, Student Workbook*

Tools and Equipment:

a. Wave shaper circuits
b. Oscilloscope
c. Voltmeter
d. Schematic manual
e. Manual
f. Screwdrivers, blade, assorted

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CLASSROOM HOURS

12

EVALUATION (ET-70)

Given a wave shaping amplifier, schematic and the necessary tools and equipment, the student will perform an operational check on the amplifier and repair any malfunctions. The repaired amplifier must meet the specific standards of operation.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

g. Screwdrivers, Phillips head, assorted
h. Wrenches, adjustable
i. Iron, soldering
j. Solder, resin core
k. Pliers, needle nose
l. Pliers, diagonal
m. Flashlight

TASK

ET-71 Identifying electrical characteristics and operating values of amplitude modulators (AM) and AM detectors

PERFORMANCE OBJECTIVE

Identify the electrical characteristics and operating valves of amplitude modulators (AM) and AM detectors.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Characteristics of AM
    1. The radiowave
    2. Sidebands
    3. Bandwidth
    4. Percent of modulation
b. Production and transmission of AM
c. AM detection and demodulation
    1. AM receivers
    2. The tuned RF receiver
    3. The superheterodyne receiver
    4. Mixers and frequency converters

(Continued on back)

Provide Demonstration On:

Identifying electrical characteristics and operating valves of amplitude modulators (AM) and AM detectors

Provide Practical Application On:

a. Draw a block diagram of a series-modulation system.
b. Mix signals in linear and non-linear devices.
c. Analyze an AM transmitter signal.

INSTRUCTIONAL MATERIALS

Textbooks:

Heathkit, Electronic Circuits

Student Manuals:

a. Heathkit, Electronic Circuits, Student Workbook
b. Georgia, Electronics, Phase C

Tools and Equipment:

a. Multimeter with leads
b. Oscilloscope with probe
c. Heathkit Experimenter (ET-3100 or equivalent)

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CLASSROOM HOURS

12

EVALUATION (ET-71)

a. Given the necessary instructions, supplies and equipment, the student will construct an oscillator that will produce a modulated signal in the AM broadcast bond and an AM detector which can recover intellignece from the RF carrier. Identify and record the electrical characteristics and operating valves of the modular and detector.

b. Test and review questions can be found in:
   1. Heathkit, Electronic Circuits, Student Workbook.
   2. Georgia, Electronics, Phase C.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

   5. The I-F amplifier
   6. Automatic volume control (AVC)
   7. An AM radio schematic

d. Other AM systems
   1. Disadvantages of standard AM
   2. Single sideband
   3. Suppressing components
   4. The balanced modulator
   5. AM and SSB variations

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Standard AM radio
e. Hook-up wire
f. Two NPN silicon transistors
g. Germanium diode
h. Transformer
i. One M ohm, ½-watt resistor
j. 100 k ohm, ½-watt resistor
k. 68 k ohm, ½-watt resistor
l. 10 k ohm, ½-watt resistor
m. 0.1 microfarad capacitor
n. 0.0022 microfarad capacitor
o. 100 pF capacitor
p. 2.7 pF capacitor
q. Alignment tool
r. One k ohm potentiometer (built into ET-3100)

TASK

ET-72 Identifying electrical characteristics and operating valves of frequency modulators (FM) and FM detectors

PERFORMANCE OBJECTIVE

Identify the electrical characteristics and operating valves of frequency modulators (FM) and FM detectors.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Characteristics of FM
   1. FM wave form
   2. Modulation percentage
   3. Sidebands
b. Modulator systems
   1. Direct FM
   2. Indirect FM
   3. Reactance tube modulator
   4. Serrasiod phase modulator
c. The FM transmitter
d. The FM receiver
e. FM detectors
   1. Shape detector
   2. Double-tuned detector
   3. Foster-Seeley discriminator
   4. Ratio detector
   5. Gated-beam detector
f. FM stereo
   1. FM stereo reception
   2. Stereophonic multiplixing
g. SCA

Provide Demonstration On:

Identifying electrical characteristics and operating valves of frequency modulators and detectors

Provide Practical Application On:

Have student practice the procedure until he/she demonstrates mastery of the task.

INSTRUCTIONAL MATERIALS

Textbooks:

Heathkit, Electronic Circuits

Student Manuals:

a. Heathkit, Electronic Circuits, Student Workbook
b. Georgia, Electronics, Phase C

Tools and Equipment:

a. Oscilloscope
b. Audio generator
c. Multimeter
d. FM radio

CLASSROOM HOURS

12

EVALUATION (ET-72)

a. Given an FM radio and the necessary supplies and equipment, the student will identify the electrical characteristics and operating valves of frequency modulators (FM) and FM detectors. Data must be identified and recorded.

b. Test and review questions can be found in:
   1. Heathkit, Electronics Circuits, Student Workbook.
   2. Georgia, Electronics, Phase C.

TASK

ET-73 Constructing and performing condition testing of superheterodyne receivers

PERFORMANCE OBJECTIVE

Construct a superheterodyne receiver, perform a receiver alignment and make signal tracing check and voltage measurements.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

- a. Review diode detector, task 5-07a
- b. Review tuned RF receiver
- c. RF signal generator
- d. Circuitry of a superheterodyne receiver
  - 1. AF amplifiers
  - 2. Review IF amplifiers, task ET-56
  - 3. Review RF amplifiers, Task ET-56
  - 4. Review oscillators, task ET-64
  - 5. Review mixers, task ET-71
  - 6. Review AVC, task ET-71

Provide Demonstration On:

- a. Alignment of an experimental superheterodyne receiver
- b. Voltage and current measurements in a transistor superheterodyne receiver

Provide Practical Application On:

Have student construct a superheterodyne receiver, perform condition test of the receiver and record test data.

INSTRUCTIONAL MATERIALS

Textbook:

Georgia, Electronics, Phase C

Tools and Equipment:

- a. Communications receiver, Heathkit model SB-310 or equivalent
- b. Table model radio receiver, Heathkit model GR-1008 or equivalent
- c. Schematics for above
- d. Dummy loads for loudspeaker
- e. Oscilloscope
- f. VTVM
- g. Signal generator
- h. Superheterodyne receiver kit

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CLASSROOM HOURS

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EVALUATION (ET-73)

a. Given the necessary instructions, supplies and equipment, the student will construct a superheterodyne receiver, align the receiver, make a signal tracing check and take voltage measurements. The completed radio must meet construction and testing specifications.

b. Test and review questions can be found in Georgia, Electronics, Phase C.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

i. Screwdrivers, blade, assorted
j. Screwdrivers, Phillips head, assorted
k. Wrenches, adjustable
l. Iron, soldering
m. Solder, resin core
n. Pliers, needle nose
o. Pliers, diagonal
p. Flashlight

TASK

ET-74 Identifying sequence and electrical characteristics of television signal development, transmission, reception and decoding

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the principles of black and white television transmission and reception, a knowledge of the stages of a black and white TV receiver and the functions of each stage.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Characteristics of the eye important to TV systems
b. Picture transmission
    1. Parallel
    2. Sequential scanning
    3. Scanning lines
c. Roster formation
    1. The vidicon
    2. Picture tube
    3. Magnetic deflection
    4. The sawtooth
d. Horizontal deflection and interlace scanning
e. Scanning frequencies
f. The seven-line roster
g. The video signal and video frequency range
h. Picture recomposition
i. The composite video signal
    1. Blanking
    2. Horizontal syne and blanking
    3. Vertical syne and blanking
    4. The hammerhead pattern
    5. The vertical interval test signal (VITS)
j. The modulated video signal
    1. Amplitude modulation
    2. Vestigial sideband transmission
    3. Frequency modulation
    4. TV station frequency allocations

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

Student Manuals:

Georgia, Electronics, Phase C

CLASSROOM HOURS

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EVALUATION (ET-74)

a. The student will sketch a basic block diagram of the necessary elements in the TV transmitter and TV receiver for picture transmission and reception and be able to describe the basic concepts of a television system on a written test.

b. Review and test questions can be found in:
   1. Liff, Color and Black and White Television, Theory and Servicing, Chapter 2.
   2. Georgia, Electronics, Phase C.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

k. The black and white television receiver
   1. The stages of the receiver
   2. The functions of each stage

TASK

ET-75 Identifying the components and electrical characteristics of a low-voltage power supply and its protective circuit

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the operation of low-voltage power supplies in television receivers, of shock hazards and causes associated with TV receivers and typical symtons of power supply problems.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Preventing shock hazard from TV receivers
b. Overload protective devices
c. Basic TV power supply arrangements
d. Types of heater circuits
e. Basic B supply circuits
    1. Half-wave
    2. Full-wave
    3. Bridge
    4. Half-wave voltage doubler
    5. Full-wave voltage doubler
f. Types of regulator circuits
g. High-frequency power supplies
h. Troubleshooting power supply problems

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

CLASSROOM HOURS 12

EVALUATION (ET-75)

a. Given a written examination, the student will respond with 70% accuracy in each of the following areas:
   1. Operation of low-voltage power supplies with television receivers
   2. Shock hazards and their causes associated with television receivers
   3. Typical symptoms of power supply problems

b. Review questions can be found in Liff, Color and Black and White Television, Theory and Servicing, Chapter 12.

TASK

ET-76 Performing condition testing on a low voltage power supply

PERFORMANCE OBJECTIVE

Perform a condition test on a low voltage power supply.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

- a. Voltage regulation in the power supply
- b. Stages of the primary power supply
  - 1. The primary circuit
  - 2. The secondary circuit and ferro-resovant power transformer
  - 3. The rectifier stage
  - 4. The filter section
  - 5. The distribution system
- c. Making a leakage current check
- d. Troubleshooting power supplies

Provide Demonstration On:

- a. The primary circuit
- b. The secondary circuit
- c. Testing rectifiers
- d. The filter section
- e. The distribution system
- f. Making a leakage current check
- g. Regulation, secondary AC voltage
- h. Regulation, B+ with load
- i. Filtering, ripple measurement

Provide Practical Application On:

Have learner perform procedures to isolate problems in a low voltage power supply.

INSTRUCTIONAL MATERIALS

Textbooks:

Quasar, Motorola Quasar Projects

Tools and Equipment:

- a. VOM, VTVM or digital multimeter
- b. 2 jumper leads
- c. 1500 ohm, 1-watt resistor
- d. 3 inch insulated sleeving
- e. Oscilloscope with vertical calibration
- f. 3 1200 ohm, 10-watt resistors
- g. Soldering iron
- h. Variac
- i. Primary power supply circuit or a television

CLASSROOM HOURS 12

EVALUATION (ET-76)

a. Given a low voltage power supply and the necessary tools and equipment, the student will determine and carry out proper procedures (ie., measure voltages and resistances, locate shorts and opens, etc.) for isolating problems in the simple parallel and series circuits of the primary power supply. Any malfunctions must be identified.

b. Test and review questions can be found in Quasar, Motorola Quasar Projects.

TASK

ET-77 Troubleshooting a defective switch-mode secondary voltage supply

PERFORMANCE OBJECTIVE

Troubleshoot a defective switch-mode secondary voltage supply.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The horizontal panel
   1. The 200-volt supply
   2. The 20-volt supply
   3. Electronic regulation of voltage

b. Transistor operation

c. Troubleshooting techniques
   1. The 200-volt supply
   2. The 20-volt supply
   3. Transistor components
   4. Modular circuits

Provide Demonstration On:

a. Adjusting regulated supplies
b. Troubleshooting modular circuits
c. Checking transistors out-of-circuit
d. Testing transistors "in circuit"
e. Electronic regulation with load variations
f. Driver wave form regulator adjustment
g. Output voltages V5 oscillator frequency changes
h. Troubleshooting: 20-volt supply 0V, 200-volt supply 105V

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

Quasar, Motorola Quasar Projects

Tools and Equipment:

a. VOM, VTVM, or digital multi-meter
b. Hex alignment tool
c. Independent power supply
d. "FC" panel
e. Soldering iron (40-watt or smaller and solder
f. 2 200 ohm, 5-watt resistors
g. 2 10K ohm, 7-watt resistors
h. 4 male power plug pins
i. Oscilloscope and probe
j. One-inch length of wire

CLASSROOM HOURS 12

EVALUATION (ET-77)

a. Given a defective switch-mode secondary voltage supply and the necessary tools and equipment, the student will isolate and correct defective modular circuits and adjust the circuitry to specifications.

b. Test and review questions are available in Quasar, Motorola Quasar Projects.

INSTRUCTIONAL MATERIALS

Provide Information On:

d. Effect of driver stage output on oscillator frequency

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

Troubleshooting switch-mode secondary voltage supplies

TASK

ET-78 Troubleshooting defective synchronizing and deflection circuits

PERFORMANCE OBJECTIVE

Troubleshoot defective synchronizing and deflection circuits in television receivers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Synchronizing and deflection circuits
    1. Function position
    2. Separation in receiver
b. Amplitude separation
c. Wave form separation
    1. The differentiator
    2. The integrator
d. Types of sync separator circuits
    1. Vacuum tube sync separators
    2. Transistor sync separators
    3. Gated tube sync separators
e. Noise set up

(Continued on back)

Provide Demonstration On:

Troubleshooting:
a. Common sync stages
b. AFC circuits
c. Horizontal oscillator
d. Vertical oscillator

Provide Practical Application On:

Introduce a problem into a television sync circuit. Have learner troubleshoot the circuit. Continue this process until the learner has mastered troubleshooting, at least, the most common problems in the sync circuit.

INSTRUCTIONAL MATERIALS

Textbooks:

Liff

Tools and Equipment:

a. Oscilloscope
b. VTVM
c. Television receiver
d. Screwdrivers, blade, assorted
e. Screwdrivers, Phillips head, assorted
f. Wrenches, adjustable
g. Iron, soldering
h. Solder, resin core
i. Pliers, needle nose
j. Pliers, diagonal
k. Flashlight

CLASSROOM HOURS

12

EVALUATION (ET-78)

Given a television receiver with a defective sync circuit and the necessary tools and equipment, the student will troubleshoot the sync circuits. Defect(s) must be identified and corrected so that the receiver meets manufacturers specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

f. Sync separator troubleshooting
g. The deflection oscillator and the sawtooth wave form
h. The discharge transistor
i. The trapezoid wave form and generator
j. The sawtooth oscillator
k. The blocking oscillator
l. The ringing coil
m. Multivibrators
n. Synchronization of deflection oscillators
o. Sine wave horizontal deflection oscillators
p. Troubleshooting deflection oscillators
g. Automatic frequency control (AFC)
    1. Phase detector AFC
    2. Troubleshooting AFC units
r. The given AFC detector
s. Anti-hunt circuits

TASK

ET-79 Troubleshooting defective horizontal output circuits

PERFORMANCE OBJECTIVE

Perform an operational check on a horizontal output circuit and repair any malfunctions that may exist.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Horizontal output amplifier systems
   1. Stages of the system
   2. Comparision of horizontal output stage in color and black and white
b. The vacuum tube horizontal output amplifier
c. B+ boost and B+ boost troubleshooting
d. Flyback transformer and yoke
e. Horizontal output amplifier controls

(Continued on back)

Provide Demonstration On:

Troubleshooting horizontal output circuits

Provide Practical Application On:

Introduce a problem into a horizontal output circuit. Have the learner troubleshoot the circuit. Continue this process until the learner has mastered at least the most common problems in the sync circuit.

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

Tools and Equipment:

a. Jumpers
b. VTVM
c. Oscilloscope
d. Power supply
e. Screwdrivers, blade, assorted
f. Screwdrivers, Phillips head, assorted
g. Wrenches, adjustable
h. Iron, soldering
i. Solder, resin core
j. Pliers, needle nose
k. Pliers, diagonal
l. Flashlight

CLASSROOM HOURS

12

EVALUATION (ET-79)

Given a television receiver, the student will perform an operational check on the horizontal output circuit. All malfunctions must be identified and corrected to operational specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

f. High-voltage focus supplies and focus circuit troubleshooting
g. High-voltage rectifiers and troubleshooting HV circuits
h. High-voltage generation and regulation
    1. In solid state receivers
    2. High-voltage hold-down circuits
i. The transistor horizontal output amplifier
j. The horizontal driver stage
k. The horizontal output stage
l. The NPN transistor horizontal output stage
m. The SCR horizontal deflection circuit and SCR troubleshooting

TASK

ET-80 Troubleshooting sweep-generator circuits

PERFORMANCE OBJECTIVE

Perform an operational check on a sweep-generator circuit and repair any malfunction that may exist.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Sweep-generator theory and operation
b. Troubleshooting with test equipment
c. Basic repair techniques

Provide Demonstration On:

a. Testing the sweep-generator circuits
b. Abnormal operating conditions of the generator
c. Troubleshooting and repairing the generator

Provide Practical Application On:

a. Test sweep-generator circuits and identify the defective circuits.
b. Repair any defects and retest the generator circuits.

INSTRUCTIONAL MATERIALS

Textbooks:

a. McGraw-Hill, A Programmed Course in Basic Pulse Circuits
b. Heathkit, Electronic Circuits

Tools and Equipment:

a. Sweep-generator
b. Oscilloscope
c. Schematic and manual
d. Hand tools
e. Voltmeter
f. Screwdrivers, blade, assorted
g. Screwdrivers, Phillips head, assorted
h. Wrenches, adjustable
i. Iron, soldering
j. Solder, resin core

(Continued on back)

CLASSROOM HOURS 12

EVALUATION (ET-80)

Given a sweep-generator, manual schematic and the necessary tools and equipment, the student will perform an operational check on the circuits. Any malfunctions must be identified and corrected to operational specifications.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

k. Pliers, needle nose
l. Pliers, diagonal
m. Flashlight

TASK

ET-81 Troubleshooting a defective high voltage supply

PERFORMANCE OBJECTIVE

Perform an operational check on the high voltage supply and repair any malfunction that may exist.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The need for high voltage
b. Components of the horizontal output stage
    1. Horizontal output transistor
    2 Horizontal output (flyback) transformer
    3. High voltage rectifier
    4. Deflection yoke
c. Focus voltage
d. Screen (G2) voltage and troubleshooting
e. Effect of change in horizontal frequency on high voltage

(Continued on back)

Provide Demonstration On:

a. Measuring high voltage
b. Horizontal frequency vs high voltage
c. Estimating high voltage without a probe
d. Checking for high voltage AC
e. Testing solid state high voltage rectifiers
f. Focus voltage
g. Troubleshooting the G2 supply
h. The horizontal output pulse
i. Additional high voltage transformer pulses

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Quasar, Motorola Quasar Projects
b. Heathkit, Electronic Circuits

Tools and Equipment:

a. Complete power supply and yoke
b. High voltage probe or meter
c. VOM, VTVM or digital multimeter
d. AC power neon tester
e. Insulated screwdriver (not wood handle)
f. Soldering iron
g. Oscilloscope and probe (low capacitance)
h. Hex adjusting tool
i. Schematic and manual

CLASSROOM HOURS

12

EVALUATION (ET-81)

Given a color television receiver, manual, schematic and the necessary tools and equipment, the student will perform an operational check on the high voltage supply. Any malfunctions must be identified and corrected to operational specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

f. The neon bulb test
g. PRV (peak-reverse-voltage) ratings
h. The horizontal output pulse
i. Safety practices and procedures
j. Spark gap protection devices

Provide Demonstration On:

j. Horizontal size coil vs horizontal deflection
k. The "stacked" G2 supply

Provide Practical Application On:

Have learner practice performing operational checks on high voltage supply, identifying malfunctions and indicating procedure for correcting.

TASK

ET-82 Troubleshooting electronic circuits

PERFORMANCE OBJECTIVE

Trace an electronic circuit and locate the component that is defective.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Troubleshooting procedure
b. How to trace a circuit using a schematic
c. The theory of circuit under study
d. Using data to locate defective parts

Provide Demonstration On:

a. Demonstrate the troubleshooting procedure.
b. Tracing the circuit under study
c. Interpreting data to identify defective part

Provide Practical Application On:

a. Practice tracing and drawing a schematic of the circuit under study.
b. Practice measuring and recording data and interpreting the data to locate the defective component.

INSTRUCTIONAL MATERIALS

Textbooks:

Prentice-Hall, Electronic Troubleshooting: A Self-Instructional Manual

Tools and Equipment:

a. Circuits to be traced for trouble
b. Schematic with data
c. Voltmeter
d. Oscilloscope

CLASSROOM HOURS 12

EVALUATION (ET-82)

Given electronic circuits, schematics with data and the necessary tools and equipment, the student will trace the circuit and identify the defective component(s). All defective components must be identified.

TASK

ET-83 Performing physical and electrical alignment of the picture tube and its associated circuits

PERFORMANCE OBJECTIVE

Align the CRT and associated circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Components of CRT and their functions
b. The horizontal sweep system
c. Degaussing
d. Elementary CRT adjustments
    1. Yoke position
    2. G2 screen control
    3. Purity
e. CRT voltages
f. Filament voltage
g. Safety

Provide Demonstration On:

a. High voltage-with and without the CRT
b. CRT socket supply voltages
c. Adjusting the G2 screen controls
d. Horizontal sweep
e. Purity rough-in
f. Checking the degaussing circuit

Provide Practical Application On:

Have the learner practice aligning CRTs and associated circuits.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Quasar, Motorola Quasar Projects
b. Tinnell, Television Symptom Diagnosis

Tools and Equipment:

a. High voltage probe 930 KV or higher)
b. VOM, VTVM or digital multimeter
c. CRT
d. Schematic and manual
e. Alignment tools

CLASSROOM HOURS 12

EVALUATION (ET-83)

a. Given a black-and-white or color television receiver, schematics, manual and the necessary tools and equipment, the student will adjust the CRT and associated circuits to operational specifications.

b. Test and review questions can be found in:
   1. Quasar, Motorola Quasar Projects.
   2. Tinnell, Television Symptom Diagnosis.

TASK

ET-84 Troubleshooting a defective vertical deflection circuit

PERFORMANCE OBJECTIVE

Troubleshoot a vertical deflection circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Deflection circuit function and arrangement
b. The vertical output stage
c. The vertical output amplifier
d. Transistor power amplifiers
e. Vertical linearity
f. Commonly used vertical deflection circuits
g. The vertical deflection multivibrator
h. The three-stage transistor multivibrator

(Continued on back)

Provide Demonstration On:

Troubleshooting a vertical deflection circuit

Provide Practical Application On:

Have learner practice troubleshooting various malfunctions in a vertical deflection circuit.

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

Tools and Equipment:

a. Television receiver
b. Oscilloscope
c. VTVM
d. Schematic and manual
e. Screwdrivers, blade, assorted
f. Screwdrivers, Phillips head, assorted
g. Wrenches, adjustable
h. Iron, soldering
i. Solder, resin core
j. Pliers, needle nose
k. Pliers, diagonal
l. Flashlight

CLASSROOM HOURS 16

EVALUATION (ET-84)

a. Given a black-and-white or color television receiver, schematics, manual and the necessary tools and equipment, the student will troubleshoot the vertical deflection circuit. All malfunctions must be identified.

b. Review and test questions can be found in Liff, Color and Black and White Television, Theory and Servicing.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

i. The Miller rundown vertical deflection circuit
j. Vertical deflection circuit troubleshooting

TASK

ET-85 Adjusting circuit operational conditions to obtain proper purity, focus and gray scale

PERFORMANCE OBJECTIVE

Adjust the vertical deflection circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Producing full raster
b. Wave forms from the vertical sweep section

Provide Demonstration On:

a. Modular circuit voltage measurements
b. Loading VS supply voltages
c. Raster adjustments
d. Wave forms of DC supply line
e. Vertical oscillator wave form
f. Vertical deflection wave form
g. Additional outputs from the "VA" panel

Provide Practical Application On:

Have learner practice adjusting for proper purity, focus and gray scale.

INSTRUCTIONAL MATERIALS

Textbooks:

Quasar, Motorola Quasar Projects

Tools and Equipment:

a. VOM, VTVM or digital multimeters
b. Hex alignment tool
c. Oscilloscope and probe
d. Soldering iron
e. Jumper cable
f. Screwdrivers, blade, assorted
g. Screwdrivers, Phillips head, assorted
h. Wrenches, adjustable

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CLASSROOM HOURS

8

EVALUATION (ET-85)

a. Given a television receiver, schematics, manual and the necessary tools and equipment, the student will adjust the purity, focus and gray scale to produce a normal raster.

b. Test and review questions can be found in Quasar, Motorola Quasar Projects.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

i. Solder, resin core
j. Pliers, needle nose
k. Pliers, diagonal
l. Flashlight

TASK

ET-86 Identifying terms and definitions used to describe the components and operational characteristics of video amplifiers

PERFORMANCE OBJECTIVE

Identify terms and definitions used to describe the components and operational characteristics of video amplifiers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Function of video amplifiers
b. Picture tube light outpost characteristics
c. Amplifier distortion
d. Types of amplifier distortion
e. Video frequency and picture content
f. Methods of frequency compensation
g. High-frequency compensation
h. Low-frequency distortion
i. DC restorers and methods of restoration
j. Video amplifier controls and typical circuits
k. Brightness limiters
l. Peaking controls
m. Automatic brightness control
n. Spot killer circuits
o. The delay line
p. Retrace blanking circuits
q. Video amplifier troubleshooting

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

CLASSROOM HOURS 14

EVALUATION (ET-86)

a. Given a television receiver or schematic of a video amplifier, the student will describe the components and operational characteristics of the amplieier. Evaluation will be based on specifications established by the instructor.

b. Review questions can be found in Liff, Color and Black and White Television, Theory and Servicing.

TASK

ET-87 Troubleshooting defective video amplifiers

PERFORMANCE OBJECTIVE

Troubleshoot a video amplifier.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Brightness and bias voltage
b. Controls
   1. Peaking-intensity-hue
   2. Picture control
   3. Super insta-matic
   4. Energy saver switch
c. Operation of the video panel
d. The gray scale
e. Blanking circuitry
f. Troubleshooting techniques
   1. Noise injection
   2. 60 Hz signal injection
   3. Generator injection

Provide Demonstration On:

a. Video panel supply voltages
b. Picture control voltages
c. Preliminary set up adjustments ("CC" panel only)
d. Video signal injection
e. 60 Hz signal injection
f. Generator injection
g. Blanking signals
h. The energy saver switch

Provide Practical Application On:

Have student troubleshoot a variety of video amplifiers.

INSTRUCTIONAL MATERIALS

Textbooks:

Quasar, Motorola Quasar Projects

Tools and Equipment:

a. Video amplifier
b. VOM, VTVM or digital multimeter
c. Jumper lead
d. Oscilloscope
e. .1 μfd, 400 V capacitor
f. 33 K ohm, ½-watt resistor
g. 680 ohm, ½-watt resistor
h. 3 alligator clips
i. Wire, 24 inch length

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CLASSROOM HOURS

12

EVALUATION (ET-87)

a. Given the necessary materials and equipment, the student will will adjust the gray scale, use an audio oscillator to produce a video pattern, determine the existence of video amplification by voltage measurements and use noise injection and low frequency line voltage troubleshooting techniques. Malfunctions must be identified.

b. Test and review questions can be found in Quasar, Motorola Quasar Projects.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

j. Insulated sleeving, 3 inches long
k. Variable frequency audio oscillator

TASK

ET-88 Identifying terms and definitions used to describe the components and operational characteristics of video IF amplifiers

PERFORMANCE OBJECTIVE

Identify terms and definitions used to describe the components and operational characteristics of video IF amplifiers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. IF stages
b. The video IF strip
c. Intercarrier sound
d. IF response
e. Color receiver IF response
f. Coupling methods
g. The integrated circuit video IF amplifier
h. The video detector
i. Troubleshooting the video IF amplifier and detector

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

Tools and equipment:

Video IF amplifier or schematic

CLASSROOM HOURS 12

EVALUATION (ET-88)

a. Given a television receiver or schematic of a video IF amplifier, the student will describe the components and operational characteristics of the amplifier. Evaluation will be based on specifications established by the instructor.

b. Review questions can be found in Liff, Color and Black and White Television, Theory and Servicing.

TASK

ET-89 Performing condition testing and align to specifications RF and IF amplifiers

PERFORMANCE OBJECTIVE

Perform a condition test and align an RF and an IF amplifier.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Signal generators
   1. The marker generator
   2. The sweep generator
b. Marker systems
   1. The marker generator
   2. The absorption marker
   3. The intensity marker
c. VHF tuner alignment
d. Video IF sweep alignment
e. The alignment process
   1. Alignment equipment
   2. Alignment hook-up
   3. Alignment procedures and precautions

Provide Demonstration On:

Procedures for performing condition testing and aligning RF and IF amplifiers

Provide Practical Application On:

Have student practice performing condition testing and aligning RF and IF amplifiers.

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

Tools and Equipment:

a. VTVM
b. Oscilloscope
c. IF amplifier
d. RF amplifier
e. Schematics
f. Screwdrivers, blade, assorted
g. Screwdrivers, Phillips head, assorted
h. Wrenches, adjustable
i. Iron, soldering
j. Solder, resin core

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CLASSROOM HOURS 12

EVALUATION (ET-89)

a. Given an RF and an IF amplifier, schematics, manuals and the necessary tools and equipment, the student will align the amplifiers. The correct procedures must be used and the amplifiers must be aligned to specifications.

b. Review questions can be found in Liff, Color and Black and White Television, Theory and Servicing.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

k. Pliers, needle nose
l. Pliers, diagonal
m. Flashlight

TASK

ET-90 Identifying terms and definitions used to describe the components and operational characteristics of sound IF and AM circuits

PERFORMANCE OBJECTIVE

Identify terms and definitions used to describe the components and operational characteristics of sound IF and AM circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Comparison of TV sound system with commercial FM receivers
b. Sound IF amplifiers
c. Sound IF amplifier circuits
d. Solid state IF amplifiers
e. An IC sound IF amplifier
f. Sound detectors
    1. The gated beam dector
    2. The quadrature grid locked-in oscillator dector
    3. The ratio detector and troubleshooting the ratio detector
    4. Integrated circuit detectors
g. Audio amplifiers
h. Transistor audio power amplifiers
i. Heat sinks
j. Troubleshooting the sound strip

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

CLASSROOM HOURS 12

EVALUATION (ET-90)

a. Given sound IF and AM circuits or schematics of the circuits, the student will describe the components and operational characteristics of the circuits. Evaluation will be based on specifications established by the instructor.

b. Review questions can be found in Liff, Color and Black and White Television, Theory and Servicing.

TASK

ET-91 Performing condition testing and align to specifications the sound IF and AM circuits

PERFORMANCE OBJECTIVE

Condition test and align the sound IF and AM circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Circuits of the sound section
b. Troubleshooting techniques
    1. The RF generator
    2. The audio oscillator
    3. Noise
    4. The mid-point troubleshooting technique

Provide Demonstration On:

a. Supply voltages at the IF panel
b. Isolating audio problems with a signal generator
c. Using noise to test the sound section
d. Troubleshooting audio problem
e. Troubleshooting video IF problem

Provide Practical Application On:

Have learner condition test and align several sound IF and AM circuits.

INSTRUCTIONAL MATERIALS

Textbooks:

Quasar, Motorola Quasar Projects

Tools and Equipment:

a. VOM, VTVM or digital multimeter
b. Audio oscillator
c. RF signal generator, modulate
d. .01 mfd, 600V capacitor
e. Television receiver
f. Alignment tools
g. Schematic

CLASSROOM HOURS 12

EVALUATION (ET-91)

a. Given a television receiver, schematic and the necessary tools and equipment, the student will condition test and align the sound IF and AM circuits. The circuits must perform to specifications.

b. Review questions can be found in Quasar, Motorola Quasar Projects.

TASK

ET-92 Identifying terms and definitions used to describe the components and operational characteristics of VHF and UHF tuner circuits

PERFORMANCE OBJECTIVE

Identify terms and definitions used to describe the components and operational characteristics of VHF and UHF tuner circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Television VHF and UHF frequency allocations
b. The VHF tuner
c. Types of VHF tuners
    1. Drum type
    2. Switch type
    3. Electronic tuners
    4. Typical VHF tuners
d. The RF amplifier
    1. Functions of RF amplifier
    2. Types of RF amplifiers
e. The mixer
f. The oscillator
g. The UHF tuners
    1. Typical VHF tuners
    2. Fully transistorized UHF tuner
h. Tuner troubleshooting
i. Cable television
    1. The MATV system
    2. The CATV system

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

CLASSROOM HOURS 12

EVALUATION (ET-92)

A. Given VHF and UHF tuner circuits or schematics of the circuits, the student will describe the components and operational characteristics of the circuits. Evaluation will be based on specifications established by the instructor.

b. Review questions can be found in Liff, Color and Black and White Television, Theory and Servicing.

TASK

ET-93 Identifying terms and definitions used to describe the components and operational characteristics of automatic fine tuning (AFT) and remote control circuits

PERFORMANCE OBJECTIVE

Identify terms and definitions used to describe the components and operational characteristics of automatic fine tuning (AFT) and remote control circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Color receiver fine tuning
b. AFT circuits
c. AFT alignment
d. Troubleshooting AFT circuits
e. The remote control system
   1. The remote control transmitter and transmitter circuit
   2. The remote control receiver
   3. On all-electronic remote control system

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

CLASSROOM HOURS 12

EVALUATION (ET-93)

a. Given automatic fine tuning (AFT) and remote control circuits or schematics of the circuits, the student will describe the components and operational characteristics of the circuits. Evaluation will be based on specifications established by the instructor.

b. Review questions can be found in Liff, Color and Black and White Television, Theory and Servicing.

TASK

ET-94 Identifying terms and definitions used to describe the components and operational characteristics of automatic gain control (AGC) and noise canceling circuits.

PERFORMANCE OBJECTIVE

Identify terms and definitions used to describe the components and operational characteristics of automatic gain control (AGC) and noise canceling circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Function of AGC circuits
b. The ideal AGC system
c. Gain control methods
d. Types of AGC systems
    1. Simple AGC
    2. Keyed AGC
    3. Noise canceling keyed AGC systems
    4. Transistor keyed AGC
e. AGC level controls
f. The complete video IF strip integrated circuit
g. Troubleshooting AGC systems

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television Theory and Servicing

Student Manuals:

Zbar, Basic Television: Theory and Servicing

CLASSROOM HOURS 12

EVALUATION (ET-94)

a. Given automatic gain control (ACG) and noise canceling circuits or schematics of the circuits, the student will describe the components and operational characteristics of the circuits. Evaluation will be based on specifications established by the instructor.

b. Review questions can be found in Liff, Color and Black and White Television, Theory and Servicing.

TASK

ET-95 Identifying terms and definitions used to describe the components and operational characteristics of color television signal development, transmission, reception and decoding

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of functions, stages and principles of operation of color television transmitters and receivers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Principles of color viewing
    1. Color characteristics
    2. Color mixing
    3 Luminance level

b. The color television transmitter

c. Phase relationships

d. Formation of the chrominance signal

e. I and Q signals

f. Frequency interlocking

g. Composite chrominance signal

h. The color receiver
    1. Circuitry
    2. Stages and controls
    3. Symptoms of defects in each stage

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

CLASSROOM HOURS 12

EVALUATION (ET-95)

a. Given a block diagram of a color transmitter and a color receiver, the student will identify and describe the functions, stages and principles of operation of color television transmitters and receivers. Evaluation will be based on specifications established by the instructor.

b. Review questions can be found in Liff, Color and Black and White Television, Theory and Servicing.

TASK

ET-96 Performing a condition test of a picture tube and its associated circuits

PERFORMANCE OBJECTIVE

Troubleshoot and isolate defective picture tubes and picture tube circuit components.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Basic structure of picture tubes
   1. Black and white
   2. Color
b. The electron gun
c. Ion burns
d. The phosphor screen
e. The shadow mask
f. Purity and purity adjustments
g. Automatic degaussing (ADG) circuits
h. Convergence
   1. Static convergence
   2. Dynamic convergence
   3. Convergence circuits
   4. Convergence adjustments

(Continued on back)

Provide Demonstration On:

a. Picture tube testing and troubleshooting
b. Color television receiver controls and adjustments
c. Color receiver set up procedure

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

Student Manuals:

Zbar, Basic Television: Theory and Servicing

Tools and Equipment:

a. Operating color TV receiver and service manual
b. Adjustment tools
c. Mirror
d. Isolation transformer (if receiver is not line-isolated)

(Continued on back)

CLASSROOM HOURS

12

EVALUATION (ET-96)

a. Given the necessary tools and equipment, the student will troubleshoot and isolate defective picture tubes and picture tube circuit components. Malfunctions must be identified.

b. Review questions can be found in Liff, Color and Black and White Television, Theory and Servicing.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

i. Pincushion cause and correction
j. The gray scale
k. Test jigs
l. The color/bar generator
m. Testing, trouble-shooting and adjustment procedures
    1. Picture tubes
    2. Color television receiver controls and adjustments
    3. Color receiver set up procedure

INSTRUCTIONAL MATERIALS

Tools and Equipment:

e. Dot-cross-hatch generator
f. High voltage probe
g. VTVM
h. Degaussing coil
i. One or more picture tubes
j. Picture tube checker and operating instructions

TASK

ET-97 Identifying terms and definitions used to describe components and operational characteristics of band-pass amplifiers and circuits

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the function and types of band-pass amplifiers, color killer circuits and automatic color control circuits and a knowledge of the symptoms and possible causes of defects in these circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Function and types of color bar generators
b. The color bar pattern
c. Function and types of band-pass amplifiers
    1 The vacuum tube-type
    2. The transistor band-pass amplifier
    3. The IC band-pass amplifier
d. Band-pass amplifier alignment
e. Video sweep modulation (VSM)
f. Troubleshooting the band-pass amplifier
g. Function and types of color killer circuits
h. Troubleshooting the killer color
i. The automatic color control circuit (ACC)
j. Troubleshooting the ACC

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

CLASSROOM HOURS 12

EVALUATION (ET-97)

a. Given a list of trouble symptoms in band-pass amplifiers, color killer circuits and automatic color control circuits, the student will identify the possible causes of the symptoms. At least seventy percent of the possible causes must be identified for each circuit.

b. Review questions can be found in Liff, Color and Black and White Television, Theory and Servicing.

TASK

A

ET-98 Identifying terms and definitions used to describe the components and operational characteristics of color sync circuits

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the function and operation of color sync circuits and a knowledge of the symptoms and possible causes of defects in these circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The burst gate
b. Troubleshooting the burst gate
c. Automatic frequency phase control (AFPC)
d. The phase detector
e. The oscillator control circuit
f. The color oscillator
g. Alignment of the phase detector AFPC
h. Troubleshooting the phase detector AFPC
i. Injection locked oscillator AFPC
j. Crystal ringing AFPC
k. The integrated circuit subcarrier processor

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

CLASSROOM HOURS 12

EVALUATION (ET-98)

a. Given a list of trouble symptoms in color sync circuits, the student will identify the possible causes of the symptoms. At least seventy percent of the possible causes must be identified.

b. Review questions can be found in Liff, Color and Black and White Television, Theory and Servicing, Chapter 17.

TASK

ET-99 Identifying terms and definitions used to describe the components and operational characteristics of color demodulator and output amplifier circuit

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of the function, operation and types of color demodulators and output amplifier circuits and a knowledge of the symptoms and possible causes of defects in these circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Function of color demodulators
b. Demodulator circuits
c. Low-level demodulators
    1. Transistor demodulators
    2. Pentrode demodulators
    3. X and Z demodulators
    4. RGB integrated circuit demodulators
d. High-level demodulators
    1. Characteristics
    2. Twin-pentrode demodulator
e. Troubleshooting demodulators
    1. DC coupled demodulators
    2. AC coupled demodulators
    3. RGB integrated circuit demodulators
f. The vectoroscope
g. Automatic tint control circuits (ATC circuits)
h. Other color television systems
    1. PAL
    2. SECAM

INSTRUCTIONAL MATERIALS

Textbooks:

Liff, Color and Black and White Television, Theory and Servicing

CLASSROOM HOURS 12

EVALUATION (ET-99)

a. Given a list of trouble symptoms in color demodulators and output amplifier circuits, the student will identify the possible causes of the symptoms. At least seventy percent of the possible causes must be identified for each circuit.

b. Review questions can be found in Liff, Color and Black and White Television, Theory and Servicing.

TASK

ET-100 Troubleshooting defective color tuning circuits

PERFORMANCE OBJECTIVE

Adjust controls, trace video and color signal paths and isolate problems.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The channel signal and its processing
    1. Synchronizing the picture (review task 6-05)
    2. Sound IF and audio (review task 8-02)
    3. AGC and AGC adjustments (review task 8-05)
b. Tuners
    1. AFT (review task 8-046)
    2. UHF and VHF
c. The video-color panel and processing

(Continued on back)

Provide Demonstration On:

a. Tuner adjustments
b. Adjusting the AGC
c. RF-AGC delay adjustment
d. AFT adjustments
e. Sound alignment-the quad coil
f. Color killer adjustment
g. Adjusting hue range
h. Super insta-matic set up
i. Touch-up adjustments
j. Troubleshooting by symptoms
k. Using a scope to set the AC
l. Tracing the video signal
m. The color signal

Provide Practical Application On:

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

Quasar, Motorola Quasar Projects

Tools and Equipment:

a. TV receiver with antenna system
b. Screwdriver
c. VOM, VTVM or digital multi-meter
d. Hex alignment tool
e. Super insta-matic set up tool
f. Jumper lead
g. High voltage meter, 30KV
h. Oscilloscope
i. RF type cross-hatch generator (optional)
j. Color bar generator

CLASSROOM HOURS

18

EVALUATION (ET-100)

a. Given the necessary tools and equipment, the student will adjust the following controls for optimum television performance.
   1. UHG and VHF tuners
   2. AGC controls
   3. RF and AGC delay control
   4. AFT
   5. Audio detector (quad coil)
   6. Color killer control
   7. Hue range
   8. Super insta-matic feature

   Each adjustment must meet specifications established by the instructor.

b. Given the necessary equipment, the student will trace the video signal path and the color signal path. The student must be able to trace the paths accurately.

c. Given trouble symptoms, the student will isolate problems to a specific section of a receiver. The specific section must be identified.

d. Review questions can be found in Quasar, Motorola Quasar Projects.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

   1. Color sync and oscillators (review task 9-03)
   2. Hue control
   3. Demodulation (review task 9-04)

d. Color signal controls (review task 9-02)
   1. Color killer
   2. Automatic color control

e. Color intensity control
   1. Auto intensity
   2. Super insta-matic

Provide Practical Application On:

Have learner adjust television receivers, trace signal paths and isolate problems to specific sections.

TASK

ET-101 Performing condition testing and aligning to specifications of color convergence circuits

PERFORMANCE OBJECTIVE

Demonstrate the ability to use proper techniques and equipment to produce linear raster and pincushion connection, to adjust purity and gray scale, to adjust static and dynamic convergence, to troubleshoot sync circuits and to adjust hold controls.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Convergence
    1. Dynamic
    2. Static
b. Pincushion distortion

Provide Practical Application On:

a. Dot-cross-hatch generator patterns
b. Pre-convergence raster adjustments
c. Static convergence
d. Dynamic convergence
e. Loss of dynamic convergence
f. Loss of pincushion correction
g. Dot-cross-hatch output signals
h. Sync separator and inverter
i. Convergence wave forms

INSTRUCTIONAL MATERIALS

Textbooks:

Quasar, Motorola Quasar Projects

Tools and Equipment:

a. Jumper lead
b. Hex-head alignment tool
c. 1/4 inch nut driver
d. Jumper cable
e. 1/4 inch spintite
f. Diagonal cutters
g. Soldering iron or gun
h. Oscilloscope
i. VTVM

CLASSROOM HOURS

12

EVALUATION (ET-101)

a. Given the necessary materials and equipment, the student will
   1. Adjust vertical size and linearity controls to obtain linear raster.
   2. Adjust pincushion coil for proper pincushion correction.
   3. Adjust purity and gray scale.
   4. Adjust dynamic and static convergence controls.
   5. Use an oscilloscope for troubleshooting sync circuits.
   6. Use dot-cross-hatch generator patterns to adjust horizontal and vertical hold controls.

   The adjustments must meet specifications established by the instructor.

b. Review questions can be found in Quasar, Motorola Quasar Projects.

TASK

ET-102 Performing condition test and calibration of volt-ohm-milliammeter (VOM).

PERFORMANCE OBJECTIVE

Perform a functional condition test and calibrate to determine if operational range of a VOM is within specification.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of VOMs
b. Simplified circuit
   1. Voltmeter
   2. Ohmmeter
   3. Milliammeter
c. Specific differences of various types and models of VOMs
d. The use of standards for comparison during calibration process
e. Traceability of standards from working (bench) to National Bureau of Standards (NBS)

(Continued on back)

Provide Demonstration On:

a. Selecting a standard
b. Calibration procedure
c. Decision to accept or reject test instrument
d. Initiating corrective action on rejects

Provide Practical Application On:

a. Select a standard.
b. Procedure for calibration
c. Decision to accept or reject test instrument
d. Write a repair order for items not meeting specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Test instrument service manual
b. Standards service manuals
c. Noll, *Basic Electronics Math with a Scientific Calculator*

Tools and Equipment:

a. Screwdrivers
b. Wrenches
c. Pliers
d. Flashlight
e. Calibration procedure
f. DC standard
g. Calibrated leads
h. Calculator

CLASSROOM HOURS

12

EVALUATION (ET-102)

a. Given a calibration standard, VOM, tools, references and supplies, the student will perform a condition test and calibration of the VOM. A written analysis of data collected will indicate acceptance or rejection of the unit. Rejections will require initiating a repair order.

b. U.S. Army, Calibration Specialist: Skill Levels 1 and 2.

c. U.S. Army, Calibration Specialist: Skill Level 3.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

f. Types of standards
g. Performing condition test
h. Calibration procedure

TASK

ET-103 Performing condition test and calibration of electrical voltmeters (EVM)

PERFORMANCE OBJECTIVE

Perform a functional condition test and calibrate to determine if operational range of an EVM is within specification.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types and models of EVM
b. Simplified circuit:
    1. Loading (input)
    2. Range selection
    3. Internal standard
    4. Comparitor network
    5. Output circuit
    6. Indicator
c. Specific differences of various types and models
d. Selection of a standard
e. Performing a condition test
f. Performing a calibration

Provide Demonstration On:

a. Selecting a standard
b. Calibration procedure
c. Decision to accept or reject the test instrument
d. Initiating corrective action on rejected items

Provide Practical Application On:

a. Selecting a standard
b. Calibration process
c. Decision to accept or reject the test instrument
d. Write a repair order for items not meeting specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Test instrument service manual
b. Standards service manuals
c. Noll, Basic Electronics Math with a Scientific Calculator

Tools and Equipment:

a. Screwdrivers
b. Wrenches
c. Pliers
d. Flashlight
e. Calibration procedure
f. AC standard
g. Calibration leads
h. Calculator

CLASSROOM HOURS 12

EVALUATION (ET-103)

a. Given a calibration standard, EVM, tools, references and supplies, the student will perform a condition test and calibration of the EVM. A written analysis of data collected will indicate acceptance or rejection of the item. Rejections will require initiating a repair order.

b. U.S. Army, Calibration Specialist: Skill Levels 1 and 2.

c. U.S. Army, Calibration Specialist: Skill Level 3.

TASK

ET-104 Performing condition test and calibration of tube testers

PERFORMANCE OBJECTIVE

Perform a functional condition test and calibrate to determine if operational range of a tube tester is within specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types and models of tube testers
b. Simplified circuit
    1. Filament range
    2. Internal standard
    3. Tube element range selection
    4. Output circuit
    5. Short indicator
    6. Condition indicator
c. Specific differences of various types and models
d. Selection of a standard
e. Performing a condition test (equipment service manual)
f. Performing a calibration

Provide Demonstration On:

a. Selecting a standard
b. Calibration procedure
c. Decision to accept or reject the test instrument
d. Initiating corrective action on rejected item

Provide Practical Application On:

a. Selection of a standard
b. Calibration process
c. Decision to accept or reject the test instrument
d. Write a repair order for an item not meeting specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Test instrument service manual
b. Standards service manuals
c. Noll, Basic Electronics Math with a Scientific Calculator

Tools and Equipment:

a. Screwdrivers
b. Wrenches
c. Pliers
d. Flashlight
e. Calibration procedure
f. DC standard
g. AC standard
h. Electronic voltmeter
i. Calculator

CLASSROOM HOURS 12

EVALUATION (ET-104)

a. Given a calibration standard, tube tester, tools, references and supplies, the student will perform a condition test and calibration of the tube tester. A written analysis of data collected will indicate acceptance or rejection of the item. Rejections will require initiating a repair order.

b. U.S. Army, Calibration Specialist: Skill Levels 1 and 2.

c. U.S. Army, Calibration Specialist: Skill Level 3.

TASK

ET-105 Performing condition test and calibration of a transistor tester

PERFORMANCE OBJECTIVE

Perform a functional condition test and calibrate to determine if operational range of transistor tester is within specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types and models of transistor testers
b. Simplified circuit
    1. Power supply
    2. Internal standard
    3. Range selection for each element of transistor
    4. Output circuit
    5. Indicator circuit
c. Precaution to observe for
    1. In-circuit test
    2. Out-of-circuit test
d. Specific differences of various types and models

(Continued on back)

Provide Demonstration On:

a. Selecting a standard
b. Calibration procedure
c. Decision to accept or reject the test instrument
d. Initiating corrective action on rejected item

Provide Practical Application On:

a. Selecting a standard
b. Calibration process
c. Decision to accept or reject the test instrument
d. Write a repair order for an item not meeting specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Test instrument service manual
b. Standards service manuals
c. Noll, Basic Electronics Math with a Scientific Calculator

Tools and Equipment:

a. Screwdrivers
b. Wrenches
c. Pliers
d. Flashlight
e. Calibration procedure
f. DC standard
g. AC standard
h. Electron voltmeter
i. Oscilloscope
j. Signal generator
k. Transistors
l. Calculator

CLASSROOM HOURS

12

EVALUATION (ET-105)

a. Given a calibration standard, transistor tester, tools, references and supplies, the student will perform a condition test and calibration of the transistor tester. A written analysis of data collected will indicate acceptance or rejection of the item. Rejections will require initiating a repair order.

b. U.S. Army, Calibration Specialist: Skill Levels 1 and 2.

c. U.S. Army, Calibration Specialist: Skill Level 3.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

e. Selection of a standard
f. Performing the condition test
g. Performing the calibration

TASK

ET-106 Performing condition test and calibration of resistor substitution box

PERFORMANCE OBJECTIVE

Perform a functional condition test and calibrate to determine if operational range of the resistor substitution box is within specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types and models of resistor substitution boxes
b. Simplified circuit
   1. Total range
   2. Step switches
c. Specific difference of various types and models of resistor substitution boxes
   1. Range
   2. Steps
   3. Accuracy
   4. Power handling capability
d. Selection of a standard

Provide Demonstration On:

a. Selecting a standard
b. Calibration procedure
c. Decision to accept or reject the test instrument
d. Initiating corrective action on rejected item

Provide Practical Application On:

a. Select a standard.
b. Calibration process
c. Decision to accept or reject the test instrument
d. Write a repair order for an item not meeting specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Test instrument service manual
b. Standards service manuals
c. Noll, Basic Electronics Math with a Scientific Calculator

Tools and Equipment:

a. Screwdrivers
b. Wrenches
c. Pliers
d. Flashlight
e. Calibration procedure
f. Resistance bridge
g. Calculator

CLASSROOM HOURS 6

EVALUATION (ET-106)

a. Given a calibration standard, resistance substitution box, tools, references and supplies, the student will perform a condition test and calibration of the resistance substitution box. A written analysis of data collected will indicate acceptance or rejection of the item. Rejections will require initiating a repair order

b. U.S. Army, Calibration Specialist: Skill Levels 1 and 2.

c. U.S. Army, Calibration Specialist: Skill Level 3.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

e. Performing a condition test (equipment service manual)
f. Performing a calibration

TASK

ET-107 Performing condition test and calibration of oscilloscopes

PERFORMANCE OBJECTIVE

Perform a functional condition test and calibrate to determine if operational range of an oscilloscope is within specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types and models of oscilloscopes
b. Simplified circuit
    1. Voltage range (amplitude)
    2. Timing range (frequency)
    3. Deflection circuit
c. Special differences of various types and models of oscilloscopes
d. Selection of standards
e. Performing a condition test
f. Performing a calibration

Provide Demonstration On:

a. Selecting a standard
b. Calibration procedure
c. Decision to accept or reject the test instrument
d. Initiating corrective action on rejected items

Provide Practical Application On:

a. Select a standard.
b. Calibration process
c. Decision to accept or reject the test instrument
d. Write a repair order for an item not meeting specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Test instrument service manual
b. Standards service manuals
c. Noll, Basic Electronics Math with a Scientific Calculator

Tools and Equipment:

a. Screwdrivers
b. Wrenches
c. Pliers
d. Flashlight
e. Alignment tools (non-conductive)
f. Calibration procedure
g. AF and RF signal generators
h. Constant amplitude generator
i. Timing calibrator

(Continued on back)

CLASSROOM HOURS

14

EVALUATION (ET-107)

a. Given a calibration standard, oscilloscope, tools, references and supplies, the student will perform a condition test and calibration of the oscilloscope. A written analysis of data collected will indicate acceptance or rejection of the item. Rejections will require initiating a repair order.

b. U.S. Army, Calibration Specialist: Skill Levels 1 and 2.

c. U.S. Army, Calibration Specialist: Skill Level 3.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

j. Electronic voltmeter
k. Frequency counter
l. Calculator

TASK

ET-108 Performing condition test and calibration of sine wave generators

PERFORMANCE OBJECTIVE

Perform a functional condition test and calibrate to determine if operational range of a sine wave generator is within specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types and models of sine wave generators
b. Simplified circuit
   1. Basic oscillator
   2. Frequency determining components and method of variation
   3. Constant level output
   4. Amplitude control
c. Specific differences of various types and models of sine wave generators
d. Selection of standards
e. Performing a condition test
f. Performing a calibration

Provide Demonstration On:

a. Selecting a standard
b. Calibration procedure
c. Decision to accept or reject the test instrument
d. Initiating corrective action on rejected items

Provide Practical Application On:

a. Select a standard.
b. Calibration process
c. Decision to accept or reject the test instrument
d. Write a repair order for an item not within specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Test instrument service manual
b. Standards service manuals
c. Noll, Basic Electronics Math with a Scientific Calculator

Tools and Equipment:

a. Screwdrivers
b. Wrenches
c. Pliers
d. Flashlight
e. Alignment tools (non-conductive)
f. Calibration procedures
g. Electronic voltmeter
h. Frequency counter
i. Calculator

CLASSROOM HOURS

12

EVALUATION (ET-108)

a. Given a calibration standard, sine wave generator, tools, references and supplies, the student will perform a condition test and calibration of the sine wave generator. A written analysis of data collected will indicate acceptance or rejection of the item. Rejections will require initiating a repair order.

b. U.S. Army, Calibration Specialist: Skill Levels 1 and 2.

c. U.S. Army, Calibration Specialist: Skill Level 3.

TASK

ET-109 Performing condition test and calibration of square wave and pulse generators

PERFORMANCE OBJECTIVE

Perform a functional condition test and calibrate to determine if operational range of square wave and pulse generators are within specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types and models
   1. Square wave
   2. Pulse
   3. Combinations (function generator)
b. Simplified circuit
   1. Basic oscillator
   2. Shaping network
   3. Triggering network
   4. amplitude control
c. Specific differences of various types and models of pulse and square wave generators
d. Selection of standards
e. Performing the condition test
f. Performing the calibration

Provide Demonstration On:

a. Selecting a standard
b. Calibration procedures
c. Decision to accept or reject the test instrument
d. Initiating corrective action on rejected items

Provide Practical Application On:

a. Select a standard.
b. Calibration process
c. Decision to accept or reject the test instrument
d. Write a repair order on items not meeting specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Test instrument service manual
b. Standards service manuals
c. Noll, *Basic Electronics Math with a Scientific Calculator*

Tools and Equipment:

a. Screwdrivers
b. Wrenches
c. Pliers
d. Flashlight
e. Alignment tools (non-conductive)
f. Calibration procedure
g. Electronic voltmeter
h. Frequency counter
i. Oscilloscope
j. Calculator

CLASSROOM HOURS

12

EVALUATION (ET-109)

a. Given a calibration standard, square wave and pulse generators, tools, references and supplies, the student will perform a condition test and calibration of the square wave and pulse generators. A written analysis of the data collected will indicate acceptance or rejection of the items. Rejections will require initiating a repair order.

b. U.S. Army, Calibration Specialist: Levels 1 and 2.

c. U.S. Army, Calibration Specialist: Level 3.

TASK

ET-110 Performing condition test and calibration of frequency meters

PERFORMANCE OBJECTIVE

Perform a functional condition test and calibrate to determine if operational range of a frequency meter is within specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types and models of frequency meters
b. Simplified circuit
    1. Input amplitude control
    2. Internal standard
    3. Comparitor network
    4. Output
    5. Indicator
c. Specific differences of various types and models of frequency meters
d. Selection of standards
e. Performing a condition test
f. Performing a calibration

Provide Demonstration On:

a. Selecting a standard
b. Calibration procedure
c. Decision to accept or reject the test instrument
d. Initiating corrective action on rejected items

Provide Practical Application On:

a. Select a standard.
b. Calibration process
c. Decision to accept or reject the test instrument
d. Write a repair order for an item not within specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Test instrument service manual
b. Standards service manuals
c. Noll, Basic Electronics Math with a Scientific Calculator

Tools and Equipment:

a. Screwdrivers
b. Wrenches
c. Pliers
d. Flashlight
e. Alignment tools (non-conductive)
f. Calibration procedure
g. Electronic counter
h. Signal generator
i. Pulse generator
j. Electronic voltmeter
k. Ratio transformer
l. Calculator

CLASSROOM HOURS	12

EVALUATION (ET-110)

a. Given a calibration standard, frequency meter, tools, references and supplies, the student will perform a condition test and calibration of the frequency meter. A written analysis of data collected will indicate acceptance or rejection of the item. Rejections will require initiating a repair order.

b. U.S. Army, Calibration Specialist: Skill Levels 1 and 2.

c. U.S. Army, Calibration Specialist: Skill Level 3.

TASK

ET-111 Performing a visual inspection of electronic equipment

PERFORMANCE OBJECTIVE

Perform a visual inspection on a piece of electronic equipment and identify any abnormal conditions.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. How to inspect equipment for physical damage (rough handling)
b. How to identify possible danger signs
    1. Circuit overheat
    2. Cracked insulation
    3. Dust and dirt
    4. Fatigue fractures
    5. Loose lock nuts, set screws
    6. Evidence of arcing
    7. Broken wiring
    8. Broken components

Provide Demonstration On:

a. Inspecting equipment for physical damage
b. Identifying possible danger signals

Provide Practical Application On:

a. Inspect equipment for physical damage.
b. Identify possible danger signals.

INSTRUCTIONAL MATERIALS

Textbooks:

Equipment service manuals

Tools and Equipment:

a. Screwdrivers
b. Inspection manual
c. Inspection probe (non-conductive)
d. Flashlight
e. Compressed air
f. Goggles/safety glasses
g. Checklist

CLASSROOM HOURS

10

EVALUATION (ET-111)

Given guidelines, tools and supplies for performing a visual inspection of known equipment, the student will perform a visual inspection and record condition of equipment on appropriate checklist.

TASK

ET-112 Cleaning electronic equipment

PERFORMANCE OBJECTIVE

Clean a piece of electronic equipment to required standards.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cleaning standards:
    1. Exterior (cabinets)
    2. Interior (chassis)
    3. Operator controls
    4. "Dirt free" components/areas
    5. Face of CRT
    6. Movable hardware

b. Types of cleaning supplies
    1. Compressed air
    2. Solvents
    3. Water
    4. Brushes (various)
    5. Paper towels
    6. Cloth rags
    7. Anti-static solution
    8. Cotton swabs
    9. Lens tissue

Provide Demonstration On:

Cleaning electronic equipment

Provide Practical Application On:

Clean electronic equipment.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Equipment service manuals
b. Solvent specifications

Tools and Equipment:

a. Screwdrivers
b. Inspection mirror
c. Inspection probe (nonconductive)
d. Inspection light
e. Compressed air
f. Goggles/safety glasses
g. Checklist
h. Solvents
i. Water
j. Brushes
k. Paper towels

(Continued on back)

CLASSROOM HOURS

12

EVALUATION (ET-112)

a. Given equipment, tools and supplies, the student will clean an item of electronic equipment to required standards and record steps taken on a checklist. Equipment must meet standards demonstrated by the instructor or stated on the checklist.

b. V-TECS, Electronics Mechanics, Task No. E-02 - E-13.

c. V-TECS, Radio-Television, Task No. 159.

d. V-TECS, Radio Communications Technician, Tasks No. 22 and 43.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

l. Cloth rags
m. Anti-static solution
n. Cotton swabs

TASK

ET-113 Lubricating electronic equipment

PERFORMANCE OBJECTIVE

Lubricate a piece of electronic equipment to required standards.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of lubricants
   1. Non-conductive
   2. Conductive
   3. For high heat areas
   4. By viscosity rating

b. Types of materials lubricants used on
   1. Metals
   2. Plastics
   3. Plant fiber
   4. Carbon surface

c. Tools for application
   1. Oilers (various)
   2. Drop tube (straw)
   3. Paddles
   4. Probes
   5. Pads
   6. Tubes of grease

Provide Demonstration On:

Lubricating electronic equipment

Provide Practical Application On:

Lubricate electronic equipment.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Equipment service manuals
b. Lubricant specifications

Tools and Equipment:

a. Handtools
b. Inspection mirror
c. Inspection probe (non-conductive)
d. Inspection light
e. Checklist
f. Oilers (various)
g. Drop tube (straw)
h. Paddles (various sizes)
i. Probes
j. Cloth rags
k. Cleaning pads
l. Tubes of grease

CLASSROOM HOURS

18

EVALUATION (ET-113)

a. Given equipment, tools and supplies, the student will lubricate an item of electronic equipment to required standards and record steps taken on a checklist. Equipment must meet standards demonstrated by the instructor or stated on the checklist.

b. V-TECS, Radio-Television, Task No. 56.

TASK

ET-114 Inspecting and replacing power cords and distribution cables

PERFORMANCE OBJECTIVE

Inspect and replace power cords and distribution cables.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Materials used
    1. Cords
    2. Cables
    3. Cable ties
    4. Clamps
    5. Connectors
    6. Lacing
b. Assembly methods
c. Possible damage
    1. Physical abuse
    2. Electrical overload
d. Visual inspections
e. Testing with instruments
    1. VOM
    2. Reflectometer

Provide Demonstration On:

a. Cords and cable sets
b. Referencing standards and recording maintenance actions
c. Performing condition test

Provide Practical Application On:

a. Perform condition tests
b. Reference standards and record maintenance actions

INSTRUCTIONAL MATERIALS

Textbooks:

a. Duarte, *Electronics Assembly and Fabrication Methods*
b. Equipment service manual
c. Test equipment operation manual
d. Parts catalogs

Tools and Equipment:

a. Screwdrivers
b. Wrenches
c. Soldering iron
d. Solder
e. Pliers
f. Flashlight
g. Solder remover
h. VOM
i. Reflectometer
j. Cord and/or wiring

CLASSROOM HOURS

12

EVALUATION (ET-114)

a. Given power cords, distribution cables, tools, supplies and test instruments, the student will inspect and repair cords and cables to required standards, as either demonstrated by the instructor or stated on the checklist.

b. V-TECS, Electronics Mechanics, Task No. E-19.

c. V'TECS, Radio Communications Technician, Task No. 19.

TASK

ET-115 Inspecting and replacing vacuum tubes

PERFORMANCE OBJECTIVE

Inspect and replace vacuum tubes which are component parts of electronic equipment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Removal and installation of vacuum tubes
b. Operation of tube testers
c. Procedures for testing a specific vacuum tube
d. Control of defective tubes (methods of discarding which observe environmental protection requirements)
e. Signal tracing and condition testing

Provide Demonstration On:

a. Signal tracing through tube of operating equipment with oscilloscope
b. Voltage measuring tube using EVM
c. Removing and inspecting tubes
d. Testing tube on tube tester
e. Procedures for control of defective tubes

Provide Practical Application On:

a. Signal trace tubes with oscilloscope.

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Equipment service manual
b. Tube manuals
c. Applicable legal restrictions
d. Parts catalogs
e. Tube tester operation manual

Tools and Equipment:

a. Tube
b. Screwdrivers
c. Pliers
d. Wrenches
e. Tube tester
f. EVM
g. Oscilloscope
h. Times 1 probe
i. Times 10 probe

CLASSROOM HOURS

10

EVALUATION (ET-115)

a. Given equipment, tools, supplies and test instruments, the student will correctly locate defective tube and replace it. Voltage tests and wave form analysis will be used to determine defective tube and verify normal operation after tube is replaced.

b. V-TECS, Electronics Mechanics, Task No. F-45.

c. V-TECS, Radio-Television, Task No. 26.

d. V-TECS, Radio Communications Technician, Task No. 37.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

b. Use EVM to measure voltage.
c. Remove and inspect tubes.
d. Test tubes.

TASK

ET-116 Inspecting and replacing transistors

PERFORMANCE OBJECTIVE

Inspect transistors using VOM, EVM, oscilloscope and transistor tester and replace those found to be defective.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Gaining access to circuit with transistor
b. Visual inspection
c. In-circuit testing
   1. Live circuit
   2 Circuit de-energized
d. Removal of defective transistor
e. Condition test using transistor tester
f. Replacing transitors
g. Cautions
   1. Connector tab alignment during replacement
   2. If soldering required, avoid solder bridges between connectors and avoid excessive heat

Provide Demonstration On:

a. Equipment having transistors mounted in sockets
b. Equipment having transistors with leads soldered
c. Procedures for inspecting transistors
d. Techniques of removal and replacement

Provide Practical Application On:

a. Inspect transistors.
b. Remove and replace transistors.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Transistor manuals
b. Equipment service manuals
c. Parts catalogs
d. Transistor tester operation manual

Tools and Equipment:

a. Screwdrivers
b. Wrenches
c. Soldering iron
d. Solder
e. Pliers
f. Flashlight
g. Transistor
h. VOM
i. Oscilloscope
j. EVM

CLASSROOM HOURS 18

EVALUATION (ET-116)

a. Given equipment, tools, supplies, test instruments and references, the student will accurately locate and replace the defective transistor. Voltage tests and wave form analysis will be used to determine fault and verify normal operation after replacement.

b. V-TECS, Electronic Mechanics, Task No. F-43.

c. V-TECS, Radio-Television, Task No. 23.

d. V-TECS, Radio Communications Technician, Task No. 34.

TASK

ET-117 Inspecting and replacing IC units

PERFORMANCE OBJECTIVE

Inspect IC units using VOM, EVM, oscilloscope and replace those found to be defective.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

- a. Typical IC units
- b. Circuits IC units used in
- c. How to remove and replace the IC unit
  - 1. Gain access to IC unit.
  - 2. Install heat sinks as applicable.
  - 3. Desoldering of defective IC units.
  - 4. Remove excess solder and resin.
  - 5. Install replacement IC.
  - 6. Install heat sinks as applicable.
  - 7. Check that solder bridges do not exist.

(Continued on back)

Provide Demonstration On:

- a. Normal in-circuit voltage and resistance for IC units
- b. How to compare measured results with normal range and determine defective IC
- c. Procedure for removal and replacement
- d. Operational check to conform equipment meets specifications

Provide Practical Application On:

- a. Check voltage and resistance at reference points.

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

- a. IC data manuals
- b. Equipment service manuals
- c. Parts catalogs
- d. Test instrument operation manuals

Tools and Equipment:

- a. Screwdrivers
- b. Soldering iron
- c. Pliers
- d. Solvent
- e. Solder
- f. Heat sinks
- g. Wire brush
- h. IC units
- i. VOM
- j. Oscilloscope

CLASSROOM HOURS	24

EVALUATION (ET-117)

a. Given equipment, tools, supplies and test instruments and references, the student will locate defective IC unit and replace it. Voltage, resistance and wave form analysis will be used to determine the defective IC unit and verify normal operation after IC unit is replaced.

b. V-TECS, Electronics Mechanics, Task No. F-15.

c. V-TECS, Radio Communications Technician, Task No. 40.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

8. Remove excess solder.
9. Remove heat sinks.
10. Remove excess resin.

Provide Practical Application On:

b. Analyze measurements to locate faulty component.
c. Remove and replace IC units.

TASK

ET-118 Inspecting and replacing printed circuit (PC) boards

PERFORMANCE OBJECTIVE

Inspect PC board using visual and ohmmeter checks and repair or replace defective board.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of PC boards
b. Usual faults of PC boards
c. Procedure for locating a fault
d. Decision to repair or replace PC board
e. Techniques used when repairing or replacing PC boards

Provide Demonstration On:

a. Techniques of visual inspection of PC boards
b. Techniques of fault finding using an ohmmeter
c. Procedure for repair and replacement of PC boards

Provide Practical Application On:

a. Locate defective portions of PC board
b. Use of visual and ohmmeter inspection techniques
c. Repair and replace PC boards

INSTRUCTIONAL MATERIALS

Textbooks:

a. Equipment service manuals
b. Parts catalogs

Tools and Equipment:

a. Screwdrivers
b. Wrenches
c. Soldering iron
d. Solder
e. Flashlight
f. Magnifying glass
g. PC boards
h. VOM

CLASSROOM HOURS

24

EVALUATION (ET-118)

a. Given equipment, tools, supplies, test instrument and references, the student will locate defective portion(s) of a PC board and repair or replace as necessary. Repaired or replaced action must maintain equipment specifications.

b. V-TECS, Electronics Mechanics, Task No. F24.

c. V-TECS, Radio-Television, Task No. 18.

d. V-TECS, Radio Communications Technician, Task Nos. 30 and 32.

TASK

ET-119 Inspecting and replacing loudspeakers

PERFORMANCE OBJECTIVE

Inspect loudspeaker using visual and ohmmeter checks and repair or replace defective unit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of loudspeakers and methods of mounting
b. Usual faults of loudspeakers
c. Procedures for locating faults
    1. Visual inspection
    2. Ohmmeter checks
d. Decision to repair or replace
e. Procedures for repairing and replacing
f. Condition test to verify equipment conforms to specifications

Provide Demonstration On:

a. Techniques of visual inspection of loudspeakers
b. Techniques for locating defects
c. Procedure for repair or replacement
d. Perform condition test

Provide Practical Application On:

a. Inspect and locate defects in loudspeakers.
b. Determine if repair or replacement is necessary.
c. Procedures for repair or replacement
d. Final inspection for compliance to specifications

INSTRUCTIONAL MATERIALS

Textbooks:

a. Equipment service manuals
b. Parts catalogs

Tools and Equipment:

a. Screwdrivers
b. Wrenches
c. Soldering iron
d. Solder
e. Pliers
f. Flashlight
g. Loudspeaker
h. VOM

CLASSROOM HOURS 18

EVALUATION (ET-119)

a. Given equipment, tools, supplies, ohmmeter and references, the student will locate defective speaker and repair or replace it as necessary. Replacement or repair action must maintain equipment specifications.

b. V-TECS, Radio-Television, Task No. 21.

c. V-TECS, Radio Communications Technician, Task No. 20.

TASK

ET-120 Inspecting and repairing microphones

PERFORMANCE OBJECTIVE

Inspect microphones using visual and test instrument checks and repair or replace defective unit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of microphones
b. Usual defects found in microphones
c. Procedures for locating defects
    1. Visual inspection
    2. Instrument checks
d. Decision to repair or replace
e. Procedure for repairing and replacing
f. Condition test to verify equipment conforms to specifications

Provide Demonstration On:

a. Techniques of visual inspection
b. Techniques of fault detection using instruments
c. Procedure for repair or replacement
d. Performing condition test

Provide Practical Application On:

a. Inspect for and locate defects in microphones.
b. Determine if repair or replacement actions is needed.
c. Procedure for repair and replacement

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Equipment service manuals
b. Parts catalogs

Tools and Equipment:

a. Screwdrivers
b. Wrenches
c. Soldering iron
d. Solder
e. Pliers
f. Flashlight
g. Microphones
h. VOM
i. EVM
j. Oscilloscope
k. Speaker repair kit

CLASSROOM HOURS 10

EVALUATION (ET-120)

a. Given equipment, tools, supplies, test instruments and references, the student will determine the defect and repair or replace as necessary. Replacement or repair action must return unit to original specifications.

b. V-TECS, Electronics Mechanics, Task No. F-22.

c. V-TECS, Radio-Television, Task No. 32.

d. V-TECS, Radio Communications Technician, Task Nos. 15 and 19.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

d. Final inspection for compliance to specifications

TASK

ET-121 Performing a proof of performance on electronic equipment

PERFORMANCE OBJECTIVE

Perform visual and instrument checks for verifying equipment operating within range of specified tolerances.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Using written guidelines to do proof testing
b. Selection of test instruments
c. Guidelines for assembling a test configuration
d. Minimum test required for proofing
e. Recording test results

Provide Demonstration On:

a. Components or sub-assemblies
b. Conducting a proof of performance test

Provide Practical Application On:

Perform a proof of performance test.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Equipment service manuals
b. Schuster, Logical Electronic Troubleshooting

CLASSROOM HOURS 28

EVALUATION (ET-121)

a. Given guidelines for performing a proof of performance, test instruments and tools, the student will determine if results indicate operating characteristics conform to equipment specifications.

b. V-TECS Electronic Mechanics, Tasks D2-D7.

c. V-TECS Radio-Television.

d. V-TECS Radio communications Technician, Task Nos. 44-73.

TASK

ET-122 Keeping records on maintenance of equipment

PERFORMANCE OBJECTIVE

Record and file the record of maintenance actions performed on electronic equipment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Guidelines for record keeping
b. Selection of significant information for recording
c. Administrative procedures for storage and retrieval of records
d. Guidelines for discarding records

Provide Demonstration On:

a. Using guidelines to select significant information
b. Method of record keeping
c. Disposal procedures

Provide Practical Application On:

a. Gather significant data for recording.
b. Make entries reflecting maintenance actions on past tasks.
c. Establish a disposal date.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

a. Guidelines for record-keeping
b. Record log
c. Data for tasks selected by instructor

CLASSROOM HOURS 24

EVALUATION (ET-122)

a. Given guidelines and data of past maintenance actions, the student will prepare a record of significant maintenance information and establish a date for disposal.

b. V-TECS, Electronic Mechanics, Task No. C24.

c. V-TECS, Radio-Television, Task No. 175.

c. V-TECS, Radio Communications Technician, Task No. 72.

TASK

ET-123 Constructing printed circuit (PC) boards

PERFORMANCE OBJECTIVE

Layout and construct a specified printed circuit pattern on a PC board.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of PC board materials
b. Chemicals used in making a PC board
c. Step-by-step procedure to make a PC board

Provide Demonstration On:

a. How to clean and prepare the PC board
b. How to layout the pattern
c. How to develop the pattern

Provide Practical Application On:

Prepare, develop and layout a PC board.

INSTRUCTIONAL MATERIALS

Textbooks:

Lindsey, The Design and Drafting of Printed Circuit Boards

A/Vs:

Georgia, Electronics Technology, Phase A, "Printed Circuits", slide/tape 25-B

Student Manuals:

Georgia, Electronics, Phase B, Unit 25-B

Tools and Equipment:

a. PC board kit
b. Circuit to be made on PC board
c. Darkroom if photo kit is used

CLASSROOM HOURS 30

EVALUATION (ET-123)

a. Given the necessary materials to construct a PC board, the student will layout a specified circuit pattern and develop the finished PC board product. The student will install the components on the PC board and perform a proof of performance to prove the board will function 100% correctly.

b. V'TECS, Electronics Mechanics, Task No. E-14.

c. Ohio, Communication Electronics, Performance Test Items.

TASK

ET-124 Designing voltage amplifiers

PERFORMANCE OBJECTIVE

Design and build a voltage amplifier to specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Voltage amplifier design standards
b. Basic design rules
c. Limitations of a single design
d. Protoboarding and testing
e. Printed circuit layout

Provide Demonstration On:

a. How to sketch a basic design
b. How to set-up and test the design for stability, and required voltage amplification

Provide Practical Application On:

Design and build amplifier to specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

Rutkowski, Solid-State Electronics

Student Manuals:

Georgia, Electronics, Phase B, Unit 11-B

Tools and Equipment:

a. Power supply and protoboard
b. Parts for amplifier
c. Voltmeter, scope and signal source
d. Tools

CLASSROOM HOURS

24

EVALUATION (ET-124)

a. Given parts, equipment and specifications, the student will design and construct a voltage amplifier that will meet voltage and frequency response requirements.

b. Ohio, Communication Electronics, Performance Test Items.

TASK

ET-125 Designing wave shaping circuits

PERFORMANCE OBJECTIVE

Design or modify an electronic wave shaping circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Integrated RC networks
b. Differential networks
c. Filter action
d. Clipper action
e. Clamper action
f. Multivibrators

Provide Demonstration On:

a. How pulse circuits can be used to generate different waveforms
b. How RE filters, clippers and clampers can be used to modify shape of a waveform

Provide Practical Application On:

a. Make modifications to a given circuit to provide different wave forms.
b. Design a circuit to provide a specified wave form.

INSTRUCTIONAL MATERIALS

Textbooks:

a. C.T.I., Electronic Circuits and Systems
b. McGraw-Hill, A Programmed Course in Basic Pulse Circuits

Student Manuals:

Georgia, Electronics Phase B, Unit 19-B

Tools and Equipment:

a. Signal source, meters, and scope
b. Parts and protoboard

CLASSROOM HOURS

24

EVALUATION (ET-125)

a. Given parts, equipment and specifications, the student will design and construct a test circuit that will provide the signal specified.

b. Ohio, Communication Electronics, Performance Test Items.

TASK

ET-126 Designing logic circuits

PERFORMANCE OBJECTIVE

Design and construct a logic circuit to meet a required function.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Switching circuit theory
b. Boolean algebra
c. Logic handbook
d. Logic gates
e. Truth table implementation
f. All NORD/NOR logic designs

Provide Demonstration On:

a. How to construct a truth table for a logic function
b. How to write the Boolean expression for a logic circuit
c. How to simplify the expresssion
d. How to expand the expression for all NAND/NOR logic
e. How to build the circuit

Provide Practical Application On:

a. Construct a truth table for a logic problem.

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Tokheim, Digital Electronics
b. Heathkit, Digital Techniques

Student Manuals:

Georgia, Electronics, Phase B, Unit 20-B

Tools and Equipment:

Protoboard of trainers and parts

CLASSROOM HOURS 30

EVALUATION (ET-126)

a. Given parts, equipment and specifications, the student will construct a truth table, simplify the table, draw the required circuits and construct the circuit. The performance of the circuit must meet the instructor's specifications.

b. Ohio, Communication Electronics, Performance Test Items.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

b. Simplify the truth table.
c. Draw the circuit.
d. Build and test the circuit.

TASK

ET-127 Drawing electrical one-line diagrams from engineering sketches

PERFORMANCE OBJECTIVE

Draw electrical one-line diagrams from engineering sketches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition and purpose
b. System selection
    1. Radial system
    2. Primary selective system
    3. Secondary selective system
    4. Primary selective, secondary network system
c. Information sources
d. Power transformer
e. Circuit breakers
f. Fuses
g. Connected loads
h. Metering devices
i. Miscellaneous devices
j. One-line diagram examples
k. Symbol standards
l. Checklist

Provide Demonstration On:

Techniques for layout and drawing one-line diagrams

Provide Practical Application On:

Draw a one-line diagram from an engineering sketch.

INSTRUCTIONAL MATERIALS

Textbooks:

Snow, Electrical Drafting and Design

Tools and Equipment:

Drafting kit

CLASSROOM HOURS 24

EVALUATION (ET-127)

Given an engineering sketch of a one-line diagram, necessary symbol references and drafting supplies and equipment, the student will draw a one-line diagram. The student must score a "B" or better on all items using the "Design Drafting Grading Sheet".

TASK

ET-128 Drawing electrical elementary diagrams from engineering sketches

PERFORMANCE OBJECTIVE

Draw electrical elementary diagrams from engineering sketches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition and purpose
b. Symbols
c. Relays
d. Solenoids
e. Mechanically operated swithces
f. Selector switches
g. Overload relays for motor starters
h. Control power source
i. Steps in developing an elementary diagram
j. Motor starting with start-stop push
k. Motor starting with start-stop push button stations
l. Two wire control circuits
m. Sequence control
n. Wire numbers on elementary diagrams
o. Wire requirements
p. Layout and drawing techniques

Provide Demonstration On:

Techniques for laying out and drawing elementary diagrams

Provide Practical Application On:

Draw an electrical diagram from an existing engineering sketch.

INSTRUCTIONAL MATERIALS

Textbooks:

Snow, Electrical Drafting and Design

Tools and Equipment:

Drafting kit

CLASSROOM HOURS 24

EVALUATION (ET-128)

Given an engineering sketch of an electrical elementary diagram, necessary symbol references and drafting supplies and equipment, the student will draw an electrical elementary diagram. The student must score a "B" or better on all items using the "Design Drafting Grading Sheet".

TASK

ET-129 Drawing electronic schematic diagrams from engineering sketches

PERFORMANCE OBJECTIVE

Draw electronic diagrams from engineering sketches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition and purpose
b. Composition of diagrams
    1. Symbols and arrangement
    2. Signal and power flow
    3. Component identification
    4. Operating controls
c. Stage layouts
d. Switch circuitry
e. Logic diagrams
f. Filter and tuned circuits
g. Geometric systems layout
h. Simplified layouts
i. Relay circuits
j. Estimating space requirements
k. Schematic diagram practices and layout procedures
l. Integrated circuits
m. Reference information

Provide Demonstration On:

Techniques for laying out and drawing schematic diagrams

Provide Practical Application On:

Draw an electrical diagram from an existing engineering sketch.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Raskhodoff, Electrical Drafting and Design
b. Stiers, Electric Drafting

Tools and Equipment:

a. Drafting kit
b. Electronics schematic template

CLASSROOM HOURS 24

EVALUATION (ET-129)

a. Given an engineering sketch of an electronic schematic diagram, necessary symbol references and drafting supplies and equipment, the student will draw an electronic schematic diagram. The student must score a "B" or better on all items using the "Design Drafting Grading Sheet".

b. V'TECS, Electronics Mechanics, Task No. C-25.

TASK

ET-130 Laying out, taping up and drawing basic printed circuit boards

PERFORMANCE OBJECTIVE

Layout, tape up and/or draw basic printed circuit boards.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Schematic diagrams
b. Printed circuitry processes
c. Materials
d. Specifications
e. Conductor and components
    1. Conductor size
    2. Termination areas
    3. Specialized conductors in termination tapes
    4. Films and grids
    5. Tape application
    6. Tape and termination pad selection
f. Printed board design
g. Printed board layout
h. Component mounting
i. Integrated circuit grouping
j. Multi-layer printed circuit boards
k. Assemble drawings and parts layout
l. Design reference information

Provide Demonstration On:

Techniques for laying out, taping up and/or drawing printed circuit boards

Provide Practical Application On:

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Raskhodoff, Electronic Drafting and Design
b. Lindsey, The Design and Drafting of Printed Circuit Boards

Tools and Equipment:

a. Drafting kit
b. Dry transfer printed circuit boards art work materials
c. Chartpak
d. Printed circuit board template

CLASSROOM HOURS 30

EVALUATION (ET-130)

a. Given a basic electronic schematic, reference data, printed circuit art work supplies and drafting supplies and equipment, the student will layout, tape up and/or draw the foil and component side art work necessary for fabricating a printed circuit board. The student must score a "B" or better on all items using the "Design Drafting Grading Sheet".

b. V'TECS, Electronics Mechanics, Task No. C-9.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

a. Draw a PC board diagram.
b. Layout and tape up a PC board.

TASK

ET-131 Modifying schematics

PERFORMANCE OBJECTIVE

Modify an existing circuit to meet new specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. How to document circuit changes to an existing schematic
b. Examples of professional schematic modifications

Provide Demonstration On:

a. Show how a change is made to a schematic diagram.
b. Show how the change is documented.

Provide Practical Application On:

Modifying an existing circuit to meet new specifications

INSTRUCTIONAL MATERIALS

Tools and Equipment:

a. Drafting tools and table
b. Schematic to be modified
c. Modification specifications

CLASSROOM HOURS 24

EVALUATION (ET-131)

a. Given a schematic and specifications for change, the student will redraw the schematic to include the modification. Circuit performance must meet specifications.

b. V'TECS, Electronics Mechanics, Task No. C-10.

TASK

ET-132 Modifying circuits to accommodate integrated circuits (IC)

PERFORMANCE OBJECTIVE

Substitute an intergrated circuit system in place of a discrete solid state system.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. IC chip systems
b. IC handbook of applications
c. Equivalent of one chip systems

Provide Demonstration On:

a. How to find an IC chip for a specific application
b. How to integrate the IC into a convential type circuit
c. How one chip can be used to replace many components

Provide Practical Application On:

Wire an IC into a conventional circuit.

INSTRUCTIONAL MATERIALS

Textbooks:

National, Linear Application Handbook; Digital Application Handbook

Tools and Equipment:

a. Discrete component type circuit
b. IC's and handbooks
c. Test meter, scope, signal generator
d. Power supply and protoboard

CLASSROOM HOURS 24

EVALUATION (ET-132)

a. Given circuit requirements and an IC application handbook, the student will locate and build an equivalent intergrated circuit. The circuit must meet specifications when tested.

b. V'TECS, Electronics Mechanics, Task No. C-11.

TASK

ET-133 Preparing assembly guides

PERFORMANCE OBJECTIVE

Prepare a step-by-step assembly guide that can be used to build an electronic assembly.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Requirements for an assembly manual
b. A basic assembly manual
c. How to write an assembly manual

Provide Demonstration On:

a. How to use an assembly manual
b. How to go about writing an assembly manual

Provide Practical Application On:

Prepare an assembly guide on a simple wired electronic circuit.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

a. Pre-wired circuit
b. Paper and pencil
c. Parts and schematic
d. Samples of guides

CLASSROOM HOURS 24

EVALUATION (ET-133)

a. Given a prewired electronic assembly and parts to build an identical unit, the student will prepare a step-by-step assembly manual that can be used to assemble the unit to specifications.

b. V'TECS, Electronics Mechanics, Task No. C-13.

TASK

ET-134 Preparing parts lists

PERFORMANCE OBJECTIVE

Prepare a list of mechanical and electronic parts needed to construct an electronic project.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Electronic master parts catalog
b. Manufactures parts catalog
c. Electronic supply houses
d. Parts substitution

Provide Demonstration On:

a. Locate electronic parts in a catalog
b. Locate mechanical parts in a manufacture's catalog
c. Find a dealer for parts not listed in catalogs
d. Parts substitution

Provide Practical Application On:

Prepare a parts list that would be needed to construct a given electronic circuit.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

a. Catalogs
b. Electronic assembly or schematic
c. Paper, pencil
d. Samples of parts lists

CLASSROOM HOURS 30

EVALUATION (ET-134)

a. Given an electronic chasis or schematic, the student will construct a parts list that will be sufficient to build the electronic system.

b. V'TECS, Electronics Mechanics, Task No. C-16.

TASK

ET-135 Preparing preliminary sketches

PERFORMANCE OBJECTIVE

Prepare a rough preliminary sketch of an electronic circuit when given a set of circuit parameters.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Basic logic systems
b. Basic analog systems
c. Standard schematic layout
d. Standard symbols

Provide Demonstration On:

a. Layout a rough sketch of a circuit.
b. Redraw the sketch to conform to standard drafting techniques.

Provide Practical Application On:

Do rough sketches of an electronic circuit using written circuit specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

Newnes, Electronic Diagrams; Simple Circuit Building; Electronic Components; Printed Circuit Assembly; Practical Electronic Project Building; Project Planning and Building

Tools and Equipment:

a. Circuit specifications
b. Paper, pencil

CLASSROOM HOURS 24

EVALUATION (ET-135)

a. Given written requirements for a circuit function, the student will select a basic circuit design and prepare a preliminiary sketch of the circuit proposing component values and power supply requirements. The design must be functional.

b. V'TECS; Electronics Mechanics, Task No. C-8, 17.

TASK

ET-136 Drawing logic symbols

PERFORMANCE OBJECTIVE

Draw the logic symbols for: AND, OR, NOR, NAND, ECLUSIVE OR and FLIP-FLOPS.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Standard electronic logic symbols
b. Standard industrial logic symbols "NEMA"
c. Standard military logic symbols

Provide Demonstration On:

a. Draw the different logic symbols using the basic electronic standards.
b. Draw the different logic symbols using the industrial logic symbols standard.

Provide Practical Application On:

a. Draw electronic logic symbols.
b. Draw industrial logic symbols.

INSTRUCTIONAL MATERIALS

Textbooks:

Buck, Lab Volt Systems; Digital Trainer Manuals

Student Manuals:

Georgia, Electronics Technology, Microcomputer Concepts, Units MC-1, MC-2 and MC-3

Tools and Equipment:

a. Logic names
b. Digital manuals

CLASSROOM HOURS

30

EVALUATION (ET-136)

a. Given a list of gates, the learner will draw from memory the electronic and industrial symbol of each. One hundred percent accuracy is required.

b. Georgia, Microcomputer Concepts, Student Tests.

TASK

ET-137 Making truth tables for logic gates

PERFORMANCE OBJECTIVE

Produce a truth table for a 7400 TTL logic gate.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. TTL Handbook
b. AND, OR, NOR, NAND GATE functions
c. Logic truth tables

Provide Demonstration On:

a. Set up a logic chip gate for test.
b. Set up a truth table.
c. Verify the truth table with the handbook.

INSTRUCTIONAL MATERIALS

Textbooks:

Texas Instruments, TTL Data Book

Student Manuals:

a. Georgia, Electronics Technology, Microcomputer Concepts, Units MC-1, MC-2 and MC-3
b. Georgia, Electronics, Phase B, Unit 20-B

Tools and Equipment:

a. 5 volt power supply
b. 7400 chips
c. Proto board
d. Meter 260 or digital
e. Paper and pencil

CLASSROOM HOURS

30

EVALUATION (ET-137)

a. Given a 7400 chip, equipment and TTL handbook, the student will test the chip and produce a truth table that can be compared to the handbook for a good or bad decision.

b. Georgia, Microcomputer Concepts, Student Tests.

TASK

ET-138 Determining meter movement, sensitivity and resistance

PERFORMANCE OBJECTIVE

Measure the full scale current deflection and calculate the internal resistance of a meter movement.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Internal resistance of a meter movement
b. Full scale current deflection

Provide Demonstration On:

a. Measure the full deflection current.
b. Use a shunt resistor to reduce the current to one half so the shunt equals the meter resistance.
c. Use Ohm's law to calculate meter resistance.

Provide Practical Application On:

a. Measure full scale current and the meter voltage drop on several measurements.
b. Calculate "R" internal.

INSTRUCTIONAL MATERIALS

Textbooks:

Zbar, Basic Electricity

Tools and Equipment:

a. Meter movements
b. Current circuit with variable voltage

CLASSROOM HOURS 24

EVALUATION (ET-138)

Given a meter movement and necessary test equipment and circuit, the student will correctly measure the internal resistance and full scale current sensitivity of the meter movement.

TASK

ET-139 Extending the current range of a meter movement

PERFORMANCE OBJECTIVE

Calculate the current shunt needed to extend the current range of a basic meter to a required value.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Meter internal resistance
b. Meter full scale current range
c. Current divider theory
d. Excess current shuntime

Provide Demonstration On:

a. How the basic current meter circuit is built
b. How a current shunt is added to pass excessive current around the meter
c. How current shunt is calculated to provide current range desired

Provide Practical Application On:

Wire a simple current meter and then calculate a shunt that can be added to extend the current range to a required value.

INSTRUCTIONAL MATERIALS

Textbooks:

Zbar, Basic Electricity

Tools and Equipment:

a. Power supply, variable
b. Current needed
c. Test circuit
d. Variable shunts

CLASSROOM HOURS 24

EVALUATION (ET-139)

Given a current meter of known specifications, the student will calculate and add to the basic current meter a shunt that will extend the basic current meter circuit to an increased specified current range.

TASK

ET-140 Extending the voltage range of a meter movement

PERFORMANCE OBJECTIVE

Calculate the voltage multiplier resistor needed to extend the range of a simple voltmeter to a required value.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Meter internal resistance
b. Meter full-scale deflection
c. Series circuit action
d. Increased voltage requires increased circuit resistance

Provide Demonstration On:

a. Basic voltmeter circuits
b. How multiplier resistors can be switched in to change voltmeter range
c. How to calculate a multiplier resistor for a specific range

Provide Practical Application On:

a. Wire a basic voltmeter.
b. Calculate the multiplier resistors for different voltage ranges.

INSTRUCTIONAL MATERIALS

Textbooks:

Zbar, Basic Electricity

Tools and Equipment:

a. Power supply, variable
b. Meter movement with known full-scale current and internal resistance
c. Variable resistors

CLASSROOM HOURS 24

EVALUATION (ET-140)

Given a meter with known internal resistance and full-scale deflection values, the student will calculate and design extended voltmeter range multipliers to meet voltage ranges given by the instructor.

SECTION VI

REFERENCES, RESOURCES

RESOURCES

Instructional Resource Matrix

The Instructional Resource Matrix lists the instructional resources required to carry out the learning activities in each unit in the program. The resources are divided into the categories of audio visuals, textbooks and student materials.

Audio visuals are identifyied by the following symbols: slide/tapes (ST), filmstrips (FS) and transparencies (TR).

Textbooks are identified by the author(s) and title.

Textbook List

This list identifies the textbooks referenced in the Unit Guide section and on the Instructional Resource Matrix.

Audio Visuals

The suppliers of the audio visuals referenced on the Unit Guides and the Instructional Resource Matrix are listed.

Additional Instructional Resources

This section lists instructional resources which may be used in addition to those primary resources listed on the Unit Guides. The resources are divided into the categories of textbooks, pamphlets, periodicals, audio visuals and additional teaching aid resources.

Resource Addresses

Addresses of instructional materials referenced on the Unit Guides, in the Additional Instructional Resources section and the Additional Resources section are given.

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty A: Operate Hand, Power Tools and Portable Test Equipment

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-01 Observing electrical safety precautions	Career Aids, Inc.: #LX60, "Electrical Safety in the Shop" (FS); Career Aids, Inc.: #TX3-1F1, "Electricity/Electronics" (FS)		Heathkit: DC Electronics, Student Workbook; Georgia: Electronics Technology, Phase A, Unit 3-A; MAVCC: Basic Electronics 1
ET-02 Identifying and using hand tools	Hobar: "Hammer, Nails and Nailing Techniques" and "Screws and Driving Tools" (ST); DCA: "Hand Tools, Series One" (TR)	Dover Publications, Inc.: Tools and Their Uses	Plant Engineering Training Systems: Elements of Mechanics
ET-03 Identifying and using sheet metal tools	Hobar: "Sheet Metal Hand Tools" (TR); Bergwall: #507 "Sheet Metal Work" (FS)	Ludwig and McCarthy: Metal Work Technology and Practice; Walker: Modern Metal-Working	Plant Engineering Training Systems: Hand Tools, Lesson Eight; California State Department of Education: Sheet Metal Tools and Equipment Workbook
ET-04 Identifying and using power tools	Hobar: "Using Portable Power Tools", "Drill Press Parts and Controls" and "Tool Grinder" (FS)	Dover Publications, Inc.: Tools and Their Uses	Plant Engineering Training Systems: Elements of Mechanics, Lesson Eight
ET-05 Identifying and using volt-ohm milliammeters (VOM)	Georgia: Electronics Technology, Phase A, 14-A, "Use and Care of the VOM and VTVM" (ST)	Grob: Basic Electronics; Gilli: Electrical Principles for Electronics	Heathkit: DC Electronics, Student Workbook; Georgia: Electronics Technology, Phase A, Unit 14; MAVCC: Basic Electronics 1
ET-06 Identifying and using electronic voltmeters (EVM)	Georgia: Electronics Technology, Phase A, 14-A, "Use and Care of the VOM and VTVM" (ST)	Grob: Basic Electronics; Gilli: Electrical Principles for Electronics	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty A: Operate Hand, Power Tools and Portable Test Equipment

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-07 Identifying and using ohmmeters	Georgia: Electronics Technology, Phase A, 8-A, "Resistor Color Code and Use of the Ohmmeter" (ST)	Grob: Basic Electronics; Gilli: Electrical Principles for Electronics	Heathkit: DC Electronics, Student Workbook; Georgia: Electronics Technology, Phase A, Unit 8-A; MAVCC: Basic Electronics 1
ET-08 Identifying and using oscilloscopes	Georgia: Electronics Technology, Phase A, 28-A, "Function and Use of the Osc Oscillopes", (ST)	Zbar: Basic Electricity; Gilmore: Instruments and Measurements	Heathkit: Electronic Circuits, Student Workbook; Georgia: Electronics Technology, Phase A, Unit 28; MAVCC: Basic Electronics 1
ET-09 Identifying and using tube testers	Georgia: Electronics, Phase B, 13-B, (ST)		Georgia: Electronics Technology, Phase B, Unit B
ET-10 Identifying and using transistor analyzers	Georgia: Electronics, Phase B, 6-B, (ST)		Georgia: Electronics Technology, Phase B, Unit 6; Heathkit: Solid State Electronics, Student Workbook
ET-11 Identifying and using capacitor testers			Heathkit: DC Electronics, Student Workbook; Georgia: Electronics Technology, Phase A, Units 31, 32; MAVCC: Basic Electronics 1
ET-12 Identifying and using sine wave generators	Georgia: Electronics Technology, Phase A, 26-A, "AC Current and Voltage" (ST)	Grob: Basic Electronics	Heathkit: Electronic Circuits, Student Workbook; Georgia: Electronics Technology, Phase A, Unit 26; MAVCC: Basic Electronics 1

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty A: Operate Hand, Power Tools and Portable Test Equipment

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-13 Identifying and using signal generators		Grob: Basic Electronics	Georgia: Electronics Technology, Phase C, Unit 3
ET-14 Identifying and using pulse generators		Grob: Basic Electronics	Heathkit: AC Electronics, Student Workbook; MAVCC: Basic Electronics 1
ET-15 Identifying and using square wave generators		Grob: Basic Electronics	Heathkit: DC Electronics, Student Workbook; MAVCC: Basic Electronics 1
EL-16 Identifying and using impedance testers			Heathkit: AC Electronics, Student Workbook; MAVCC: Basic Electronics 1
ET-17 Identifying and using frequency meters		Grob: Basic Electronics	Heathkit: AC Electronics, Student Workbook; MAVCC: Basic Electronics 1

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty B: Identifying and Performing Condition Tests of Electrical and Electronic Components

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-18 Understanding fundamentals of electrical theory and electrical measurement		Grob: Basic Electronics; MAVCC: Basic Electronics 1; Singer: Basic Mathematics for Electricity and Electronics; Georgia: Electronics Technology, Phase A	Georgia: Electronics Technology, Phase A, Unit 9-A
ET-19 Making calculations using Ohm's law		MAVCC: Basic Electronics 1; Singer: Basic Mathematics for Electricity and Electronics; Georgia: Electronics Technology, Phase A; Grob: Basic Electronics	Meade: Programmed Projects; Georgia: Electronics Technology, Phase A, Unit 15-A
ET-20 Measuring current in DC circuits	Georgia: Electronics, Phase Phase B, 10-A, (ST)	Grob: Basic Electronics; MAVCC: Basic Electronics 1; Singer: Basic Mathematics for Electricity and Electronics; Heathkit: DC Electronics; Georgia: Electronics Technology, Phase A	Heathkit: DC Electronics, Student Workbook; Georgia: Electronics Technology, Phase A, Units 10-A and 13-A
ET-21 Measuring voltage in DC circuits	Georgia: Electronics, Phase B, 11-A, (ST)	Grob: Basic Electronics; MAVCC: Basic Electronics 1; Heathkit: DC Electronics; Georgia: Electronics Technology, Phase A	Heathkit: DC Electronics, Student Workbook; Georgia: Electronics Technology, Phase A, Units 11-A and 24-A; Meade: Programmed Projects
ET-22 Calculating and measuring resistance in DC circuits	Georgia: Electronics Technology, Phase A, 8-A, "Resistor Color Code" (ST); 8-A, "Use of the Ohmmeter" ST); and 12-A, "Using the Ohmmeter to Troubleshoot" (ST)	MAVCC: Basic Electronics 1; Heathkit: DC Electronics; Georgia: Electronics Technology, Phase A	Heathkit: DC Electronics; Georgia: Electronics Technology, Phase A, Units 8-A and 12-A

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty B: Identifying and Performing Condition Tests of Electrical and Electronic Components

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-23 Calculating voltage, current and resistance in DC series circuits		MAVCC: Basic Electronics 1; Singer: Basic Mathematics for Electricity and Electronics; Grob: Basic Electronics; Georgia: Electronics Technology, Phase A	Meade: Programmed Projects; Georgia: Electronics Technology, Phase A, Unit 18-A
ET-24 Calculating total voltage, total current and total resistance in DC parallel circuits		MAVCC: Basic Electronics 1; Singer: Basic Mathematics for Electricity and Electronics; Georgia: Electronics Technology, Phase A; Grob: Basic Electronics	Georgia: Electronics Technology, Phase A, Unit 19-A; Meade: Programmed Projects
ET-25 Calculating and measuring electrical quantities in combination DC circuits		Grob: Basic Electronics; MAVCC: Basic Electronics 1; Singer: Basic Mathematics for Electricity and Electronics; Georgia: Electronics Technology, Phase A	Georgia: Electronics Technology, Phase A, Unit 20-A; Meade: Programmed Projects
ET-26 Calculating power in DC circuits		MAVCC: Basic Electronics 1; Singer: Basic Mathematics for Electricity and Electronics; Heathkit: DC Electronics; Georgia: Electronics Technology, Phase A; Grob: Basic Electronics	Georgia: Electronics Technology, Phase A, Unit 16-A; Meade: Programmed Projects
ET-27 Applying fundamentals of magnetism and electromagnetism	Georgia: Electronics Technology, Phase A, 25-A, "Basic Introduction to Magnetism" (ST)	MAVCC: Basic Electronics 1; Heathkit: DC Electronics; Georgia: Electronics Technology, Phase A; Grob: Basic Electronics	Georgia: Electronics Technology, Phase A, Unit 25-A

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty B: Identifying and Performing Condition Tests of Electrical and Electronic Components

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-28 Using test instruments to measure voltage, current and resistance	Georgia: Electronics Technology, Phase A, 14-A, "Proper Use and Care of Meters" and "The Ayrton or Universal Meter Shunt" (ST)	Georgia: Electronics Technology, Phase A; Grob: Basic Electronics; Heathkit: DC Electronics; MAVCC: Basic Electronics 1	Georgia: Electronics Technology, Phase A, Units 14-A and 22-A; Heathkit: DC Electronics; Meade: Programmed Projects
ET-29 Calculating values in DC network circuits		Grob: Basic Electronics; Georgia: Electronics Technology, Phase A; Heathkit: DC Electronics; MAVCC: Basic Electronics 1	Meade: Programmed Projects; Georgia: Electronics Technology, Phase A, Unit 21-A; Heathkit: DC Electronics
ET-30 Calculating capacitance and time constants for RC circuits		Grob: Basic Electronics; Georgia: Electronics Technology, Phase A; Heathkit: DC Electronics; MAVCC: Basic Electronics 1	Meade: Programmed Projects; Georgia: Electronics Technology, Phase A, Unit 33-A; Heathkit: DC Electronics
ET-31 Calculating values for a right triangle		Singer: Basic Mathematics for Electricity and Electronics	
ET-32 Identifying the characteristics of AC sine waves	Georgia: Electronics Technology, Phase A, 28-A, "Introduction to Basic Oscilloscope" (ST)	Heathkit: AC Electronics; MAVCC: Basic Electronics 1; Georgia: Electronics Technology, Phase A	Georgia: Electronics Technology, Phase A, Unit 28-A
ET-33 Measuring AC values for LF circuits	Georgia: Electronics Technology, Phase A, 26-A, "Important AC Units and Terms" (ST)	Heathkit: AC Electronics; Training and Retraining, Inc.: Basic Electricity/Electronics; Grob: Basic Electronics; Georgia: Electronics Technology, Phase A	Georgia: Electronics Technology, Phase A, Unit 26-A; Heathkit: AC Electronics

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty B: Identifying and Performing Condition Tests of Electrical and Electronic Components

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-34 Determining reactance and impedance of a capacitor in either series or parallel circuits		Singer: Basic Mathematics for Electricity and Electronics; Georgia: Electronics Technology, Phase A; Grob: Basic Electronics; Training and Retraining, Inc.: Basic Electricity/Electronics; Duarte: Electronics Assembly and Fabrication Methods; Heathkit: AC Electronics	Meade: Programmed Projects; Georgia: Electronics Technology, Phase A, Unit 31-A; Heathkit: AC Electronics
ET-35 Calculating and measuring electrical values in AC capacitance circuits		Heathkit: AC Electronics; MAVCC: Basic Electronics 1; Grob: Basic Electronics Technology, Phase A	Meade: Programmed Projects; Georgia: Electronics Technology, Phase A, Unit 32-A, Heathkit: AC Electronics
ET-36 Measuring inductance in series RL circuits		Heathkit: AC Electronics; MAVCC: Basic Electronics 1; Georgia: Electronics Technology, Phase A; Grob: Basic Electronics	Georgia: Electronics Technology, Phase A, Units 27-A, 29-A and 30-A; Meade: Programmed Projects; Heathkit: AC Electronics
ET-37 Computing turns, voltage, current and impedance ratios of transformers	Georgia: Electronics Technology, Phase A, 37-A, "Transformer Impedance Ratio" (ST)	Heathkit: AC Electronics; Grob: Basic Electronics; Georgia: Electronics Technology, Phase A	Heathkit: AC Electronics; Georgia: Electronics Technology, Phase A, Unit 37-A
ET-38 Drawing phasor diagrams and calculating operating values for series AC circuits	Georgia: Electronics Technology, Phase A, 38-A, "Measuring Frequency and Phase With a Scope" (ST)	Singer: Basic Mathematics for Electricity and Electronics; Georgia: Electronics Technology, Phase A	Georgia: Electronics Technology, Phase A, Unit 38-A

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty B: Identifying and Performing Condition Tests of Electrical and Electronic Components

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-39 Drawing phasor diagrams and calculating operating values for parallel AC circuits	Georgia: Electronics Technology, Phase A, 38-A, "Measuring Frequency and Phase with a Scope" (ST)	Singer: Basic Mathematics for Electricity and Electronics; Georgia: Electronics Technology, Phase A	Georgia: Electronics Technology, Phase A, Units 34-A and 38-A
ET-40 Understanding fundamentals of tuned AC circuits		Heathkit: AC Electronics; Grob: Basic Electronics; Georgia: Electronics Technology, Phase A	Georgia: Electronics Technology, Phase A, Units 35-A and 36-A; Heathkit: AC Electronics
ET-41 Understanding fundamentals of semiconductor materials	Georgia: Electronics, Phase B, 1-B, "Semi-Conductor Devices" and 2-B, "Semi-Conductor Materials" (ST)	Heathkit: Semi-Conductor Devices; Georgia: Electronics, Phase B; Grob: Basic Electronics	Georgia: Electronics, Phase B, Units 1-B and 2-B; Heathkit: Semi-Conductor Devices; Oleksy: Solid-State Electronics
ET-42 Performing a condition test of a semiconductor diode using an ohmmeter		Heathkit: Semi-Conductor Devices; Oleksy: Solid-State Electronics; Zbar: Basic Electronics	Georgia: Electronics, Phase B, Unit 3-B; Heathkit: Semi-Conductor Devices; Oleksy: Solid-State Electronics; Zbar: Basic Electronics
ET-43 Performing a condition test of zener diodes used in regulator circuits		Heathkit: Semi-Conductor Devices; Georgia: Electronics, Phase B; Zbar: Basic Electronics	Georgia: Electronics, Phase B, Unit 3-B; Heathkit: Semi-Conductor Devices; Zbar: Basic Electronics

CURRICULUM AREA: ELECTRONIC TECHNOLOGY

Duty B: Identifying and Performing Condition Tests of Electrical and Electronic Components

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-44 Identifying symbols and electrical characteristics of tunnel, varactor and high frequency diodes		Heathkit: Semi-Conductor Devices; Georgia: Electronics, Phase B	Heathkit: Semi-Conductor Devices; Georgia: Electronics, Phase B; Oleksy: Solid-State Electronics; Zbar: Basic Electronics
ET-45 Understanding the fundamentals of bipolar transistors and their electrical characteristics		Heathkit: Semi-Conductor Devices; Georgia: Electronics, Phase B	Heathkit: Semi-Conductor Devices; Georgia: Electronics, Phase B; Zbar: Basic Electronics; Oleksy: Solid-State Electronics
ET-46 Performing condition tests of bipolar transistors		Heathkit: Semi-Conductor Devices; Georgia: Electronics, Phase B	Heathkit: Semi-Conductor Devices; Georgia: Electronics, Phase B; Zbar: Basic Electronics; Oleksy: Solid-State Electronics
ET-47 Understanding the fundamentals of field effect transistors and their electrical characteristics		Heathkit: Semi-Conductor Devices; Georgia: Electronics, Phase B	Heathkit: Semi-Conductor Devices; Georgia: Electronics, Phase B, Unit 12-B; Oleksy: Solid-State Electronics
ET-48 Understanding the fundamentals of thyristors and their electrical characteristics		Heathkit: Semi-Conductor Devices; Georgia: Electronics, Phase B	Heathkit: Semi-Conductor Devices; Georgia: Electronics, Phase B, Unit 12-B; Oleksy: Solid-State Electronics

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty B: Identifying and Performing Condition Tests of Electrical and Electronic Components

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-49 Understanding fundamentals of integrated circuits		Heathkit: Semi-Conductor Devices; Georgia: Electronics Technology, Integrated Circuits	Heathkit: Semi-Conductor Devices; Georgia: Electronics Technology, Integrated Circuits, Units IC-1 through IC-11
ET-50 Defining the operating values and applications of optoelectronic devices		Heathkit: Semi-Conductor Devices; Georgia: Electronics Technology, Integrated Circuits	Heathkit: Semi-Conductor Devices; Georgia: Electronics Technology, Integrated Circuits
ET-51 Identifying the component parts and operational characteristics of diode vacuum tubes		Grob: Basic Electronics; Manufacturer's tube manual; Georgia: Electronics, Phase B; Training and Retraining, Inc.: Basic Electricity/Electronics	Georgia: Electronics, Phase B, Unit 13-B
ET-52 Identifying the component parts and operating characteristics of triode vacuum tubes		Grob: Basic Electronics; Manufacturer's tube manual; Georgia: Electronics, Phase B; Training and Retraining, Inc.: Basic Electricity/Electronics	Georgia: Electronics, Phase B, Units 13-B and 14-B
ET-53 Identifying the component parts and operating characteristics of tetrode vacuum tubes		Grob: Basic Electronics; Manufacturer's tube manual; Training and Retraining, Inc.: Basic Electricity/Electronics	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty B: Identifying and Performing Condition Tests of Electrical and Electronic Components

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-54 Identifying the component parts and operating characteristics of pentode vacuum tubes		Grob: Basic Electronics; Manufacturer's tube manual; Training and Retraining, Inc.: Basic Electricity/ Electronics	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty C: Identify, Test Condition and Align to Specification Electrical and Electronic Sub-Assemblies

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-55 Performing condition testing of the thermal stability and operational parameters of a common-emitter amplifier circuit		Heathkit: Electronic Circuits; Grob: Basic Electronics; Shrader: Electronic Communications	Heathkit: Electronic Circuits, Student Workbook; Georgia: Electronics, Phase B
ET-56 Performing condition testing of DC and audio amplifiers		Heathkit: Electronic Circuits; Grob: Basic Electronics; Shrader: Electronic Communications	Heathkit: Electronic Circuits, Student Workbook; Georgia: Electronics, Phase B
ET-57 Defining electrical characteristics, applications and normal operational values of amplifiers		Heathkit: Electronic Circuits; Grob: Basic Electronics; Schrader: Electronic Communication	Heathkit: Electronic Circuits, Student Workbook; Georgia: Electronics, Phase B
ET-58 Testing an amplifier for amplification		Wells: Audio Servicing: Theory and Practice	Wells: Audio Servicing: A Text-Lab Manual; Georgia: Electronics, Phase B
ET-59 Testing and repairing the vacuum tube amplifier			Prentice-Hall: Troubleshooting: A Self Instructional Programmed Manual
ET-60 Testing and repairing a transistor amplifier		Lenk: Handbook of Practical Solid State Troubleshooting; Lenk: Handbook of Modern Solid State Amplifiers	Prentice-Hall: Electronic Troubleshooting: A Self Instructional Programmed Manual
ET-61 Identifying component parts and electrical characteristics of power supply circuits		Heathkit: Electronic Circuits; Grob: Basic Electronics	Heathkit: Electronic Circuits, Student Workbook; Georgia: Electronics, Phase B

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty C: Identify, Test Condition and Align to Specification Electrical and Electronic Sub-Assemblies

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-62 Testing and repairing power supplies	Films from the USAF	Grob: Basic Electronics	Prentice-Hall: Electronic Troubleshooting: A Self-Instructional Programmed Manual
ET-63 Calibrating power supply voltage		Lemons: Learn Electronics Through Troubleshooting	Prentice-Hall: Electronic Troubleshooting: A Self-Instructional Programmed Manual
ET-64 Constructing oscillators and performing a condition test of the oscillators		Heathkit: Electronic Circuits	Heathkit: Electronic Circuits, Student Workbook; Georgia: Electronics, Phase C
ET-65 Testing and repairing oscillators		Shrader: Electronic Communication; Horowitz and Hill: The Art of Electronics; Heathkit: Electronic Circuits	Heathkit: Electronic Circuits, Student Workbook; Georgia: Electronics, Phase C
ET-66 Testing and repairing clampers		McGraw-Hill: A Programmed Course in Basic Pulse Circuits	
ET-67 Testing and repairing clipper circuits		McGraw-Hill: A Programmed Course in Basic Pulse Circuits	
ET-68 Testing and repairing counters		Triebel: Integrated Digital Electronics; Tokheim: Digital Electronics; Heathkit: Digital Techniques	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY

Duty C: Identify, Test Condition and Align to Specification Electrical and Electronic Sub-Assemblies

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-69 Constructing and performing condition tests of pulse circuits		Heathkit: Electronic Circuits	Heathkit: Electronic Circuits, Student Workbook
ET-70 Testing and repairing nonsinusoidal amplifiers		Heathkit: Active Filters; Heathkit: IC Timers; Heathkit: Electronic Circuits; Horowitz and Hill: The Art of Electronics	Heathkit: Electronic Circuits, Student Workbook
ET-71 Identifying electrical characteristics and operating values of amplitude modulators (AM) and AM detectors		Heathkit: Electronic Circuits	Heathkit: Electronic Circuits, Student Workbook; Georgia: Electronics, Phase C
ET-72 Identifying electrical characteristics and operating values of frequency modulators (FM) and FM detectors		Heathkit: Electronic Circuits	Heathkit: Electronic Circuits, Student Workbook; Georgia: Electronics, Phase C
ET-73 Constructing and performing condition testing of superheterodyre receivers		Georgia: Electronics, Phase C	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty C: Identify, Test Condition and Align to Specification Electrical and Electronic Sub-Assemblies

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-74 Identifying sequence and electrical characteristics of television signal development, transmission, reception and decoding		Liff: Color and Black and White Television, Theory and Servicing	Georgia: Electronics, Phase C
ET-75 Identifying the components and electrical characteristics of a low-voltage power supply and its protective circuit		Liff: Color and Black and White Television, Theory and Servicing	
ET-76 Performing condition testing on a low voltage power supply		Quasar: Motorola Quasar Projects	
ET-77 Troubleshooting a defective switch-mode secondary voltage supply		Quasar: Motorola Quasar Projects	
ET-78 Troubleshooting defective synchronizing and deflection circuits		Liff: Color and Black and White Television, Theory and Servicing	
ET-79 Troubleshooting defective horizontal output circuits		Liff: Color and Black and White Television, Theory and Servicing	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty C: Identify, Test Condition and Align to Specification Electrical and Electronic Sub-Assemblies

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-80 Troubleshooting sweep-generator circuits		McGraw-Hill: A Programmed Course in Basic Pulse Circuits; Heathkit: Electronic Circuits	
ET-81 Troubleshooting a defective high voltage supply		Quasar: Motorola Quasar Projects; Heathkit: Electronic Circuits	
ET-82 Troubleshooting electronic circuits		Prentice-Hall: Electronic Troubleshooting: A Self-Instructional Manual	
ET-83 Performing physical and electrical alignment of the picture tube and its associated circuits		Quasar: Motorola Quasar Projects; Tinnell: Television Symptom Diagnosis	
ET-84 Troubleshooting a defective vertical deflection circuit		Liff: Color and Black and White Television, Theory and Servicing	
ET-85 Adjusting circuit operational conditions to obtain proper purity, focus and gray scale		Quasar: Motorola Quasar Projects	
ET-86 Identifying terms and definitions used to describe the components and operational characteristics of video amplifiers		Liff: Color and Black and White Television, Theory and Servicing	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty C: Identify, Test Condition and Align to Specification Electrical and Electronic Sub-Assemblies

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-87 Troubleshooting defective video amplifiers		Quasar: Motorola Quasar Projects	
ET-88 Identifying terms and definitions used to describe the components and operational characteristics of video IF amplifiers		Liff: Color and Black and White Television, Theory and Servicing	
ET-89 Performing condition testing and align to specifications RF and IF amplifiers		Liff: Color and Black and White Television, Theory and Servicing	
ET-90 Identifying terms and definitions used to describe the components and operational characteristics of sound IF and AM circuits		Liff: Color and Black and White Television, Theory and Servicing	
ET-91 Performing condition testing and align to specifications the sound IF and AM circuits		Quasar: Motorola Quasar Projects	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty C: Identify, Test Condition and Align to Specification Electrical and Electronic Sub-Assemblies

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-92 Identifying terms and definitions used to describe the components and operational characteristics of VHF and UHF tuner circuits		Liff: Color and Black and White Television, Theory and Servicing	
ET-93 Identifying terms and definitions used to describe the components and operational characteristics of automatic fine tuning (AFT) and remote control circuits		Liff: Color and Black and White Television, Theory and Servicing	
ET-94 Identifying terms and definitions used to describe the components and operational characteristics of automatic gain control (AGC) and noise canceling circuits		Liff: Color and Black and White Television, Theory and Servicing	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY

Duty C: Identify, Test Condition and Align to Specification Electrical and Electronic Sub-Assemblies

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-95 Identifying terms and definitions used to describe the components and operational characteristics of color television signal development, transmission, reception and decoding		Liff: Color and Black and White Television, Theory and Servicing	
ET-96 Performing a condition test of a picture tube and its associated circuits		Liff: Color and Black and White Television, Theory and Servicing	
ET-97 Identifying terms and definitions used to describe components and operational characteristics of band-pass amplifiers and circuits		Liff: Color and Black and White Television, Theory and Servicing	
ET-98 Identifying terms and definitions used to describe the components and operational characteristics of color sync circuits		Liff: Color and Black and White Television, Theory and Servicing	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY

Duty C: Identify, Test Condition and Align to Specification Electrical and Electronic Sub-Assemblies

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio Visuals	Textbooks	Student Materials
ET-99	Identifying terms and definitions used to describe the components and operational characteristics of color demodulator and output amplifier circuit		Liff: Color and Black and White Television, Theory and Servicing	
ET-100	Troubleshooting defective color tuning circuits		Quasar: Motorola Quasar Projects	
ET-101	Performing condition testing and aligning to specifications of color convergence circuits		Quasar: Motorola Quasar Projects	
ET-102	Performing condition test and calibration of volt-ohm-milliammeter (VOM)		Test instrument service manual; Standards service manuals; Noll: Basic Electronics Math With a Scientific Calculator	
ET-103	Performing condition test and calibration of electrical voltmeters (EVM)		Test instrument service manual; Standards service manuals; Noll: Basic Electronics Math With a Scientific Calculator	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty C: Identify, Test Condition and Align to Specification Electrical and Electronic Sub-Assemblies

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-104 Performing condition test and calibration of tube testers		Test instrument service manual; Standards service manuals; Noll: Basic Electronics Math With a Scientific Calculator	
ET-105 Performing condition test and calibration of a transistor tester		Test instrument service manual; Standards service manuals; Noll: Basic Electronics Math With a Scientific Calculator	
ET-106 Performing condition test and calibration of resistor substitution box		Test instrument service manual; Standards service manuals; Noll: Basic Electronics Math With a Scientific Calculator	
ET-107 Performing condition test and calibration of oscilloscopes		Test instrument service manual; Standards service manuals; Noll: Basic Electronics Math With a Scientific Calculator	
ET-108 Performing condition test and calibration of sine wave generators		Test instrument service manual; Standards service manuals; Noll: Basic Electronics Math With a Scientific Calculator	
ET-109 Performing condition test and calibration of square wave and pulse generators		Test instrument service manual; Standards service manuals; Noll: Basic Electronics Math With a Scientific Calculator	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty C: Identify, Test Condition and Align to Specification Electrical and Electronic Sub-Assemblies

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-110 Performing condition test and calibration of frequency meters		Test instrument service manual; Standards service manuals; Noll: Basic Electronics Math With a Scientific Calculator	

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CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty D: Maintenance of Electronic Equipment

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-111 Performing a visual inspection of electronic equipment		Equipment service manuals	
ET-112 Cleaning electronic equipment		Equipment service manuals; Solvent specifications	
ET-113 Lubricating electronic equipment		Equipment service manuals; Lubricant specifications	
ET-114 Inspecting and replacing power cords and distribution cables		Duarte: *Electronics Assembly and Fabrication Methods*; Equipment service manual; Test equipment operation manual; Parts catalogs	
ET-115 Inspecting and replacing vacuum tubes		Equipment service manual; Tube manuals; Applicable legal restrictions; Parts catalogs; Tube tester operation manual	
ET-116 Inspecting and replacing transistors		Transistor manuals; Equipment service manuals; Parts catalogs; Transistor tester operation manual	
ET-117 Inspecting and replacing IC units		IC data manuals; Equipment service manuals; Parts catalogs; Test instrument operation manuals	
ET-118 Inspecting and replacing printed circuit (PC) boards		Equipment service manuals; Parts catalogs	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty D: Maintenance of Electronic Equipment

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-119 Inspecting and replacing loudspeakers		Equipment service manuals; Parts catalogs	
ET-120 Inspecting and repairing microphones		Equipment service manuals; Parts catalogs	
ET-121 Performing a proof of performance on electronic equipment		Equipment service manuals; Schuster: Logical Electronic Troubleshooting	
ET-122 Keeping records on maintenance of equipment		Guidelines for record-keeping; Record log; Data for tasks selected by instructor	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY

Duty E: Assembling and Modifying Electronic Circuitry

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio Visuals	Textbooks	Student Materials
ET-123	Constructing printed circuit (PC) boards	Georgia: Electronics Technology, Phase A, 25-B, "Printed Circuits" (ST)	Lindsey: The Design and Drafting of Printed Circuit Boards	Georgia: Electronics Technology, Phase B, Unit 25-B
ET-124	Designing voltage amplifiers		Rutkowski: Solid-State Electronics	Georgia: Electronics Technology, Phase B, Unit 11-B
ET-125	Designing wave shaping circuits		C.T.I.: Electronic Circuits and Systems; McGraw-Hill: A Programmed Course in Basic Pulse Circuits	Georgia: Electronics Technology, Phase B, Unit 19-B
ET-126	Designing logic circuits		Tokheim: Digital Electronics; Heathkit: Digital Techniques	Georgia: Electronics Technology, Phase B, Unit 20-B
ET-127	Drawing electrical one-line diagrams from engineering sketches		Snow: Electrical Drafting and Design	
ET-128	Drawing electrical elementary diagrams from engineering sketches		Snow: Electrical Drafting and Design	
ET-129	Drawing electronic schematic diagrams from engineering sketches		Raskhodoff: Electrical Drafting and Design; Stiers: Electric Drafting	

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty E: Assembling and Modifying Electronic Circuitry

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-130 Laying out, taping up and drawing basic printed circuit boards		Raskhodoff: Electronic Drafting and Design; Lindsey: The Design and Drafting of Printed Circuit Boards	
ET-131 Modifying schematics			
ET-132 Modifying circuits to accommodate integrated circuits (IC)		National: Linear Application Handbook; Digital Application Handbook	
ET-133 Preparing assembly guides			
ET-134 Preparing parts lists			
ET-135 Preparing preliminary sketches		Newnes: Electronic Diagrams; Simple Circuit Building; Electronic Components; Printed Circuit Assembly; Practical Electronic Project Building; Project Planning and Building	
ET-136 Drawing logic symbols		Buck: Lab Volt Systems; Digital Trainer Manuals	Georgia: Electronics Technology Microcomputer Concepts, Units MC-1, MC-2 and MC-3
ET-137 Making truth tables for logic gates		Texas Instruments: TTL Data Book	Georgia: Electronics Technology Microcomputer Concepts, Units MC-1, MC-2 and MC-3

CURRICULUM AREA: ELECTRONIC TECHNOLOGY
Duty E: Assembling and Modifying Electronic Circuitry

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
ET-138 Determining meter movement, sensitivity and resistance		Zbar: Basic Electricity	
ET-139 Extending the current range of a meter movement		Zbar: Basic Electricity	
ET-140 Extending the voltage range of a meter movement		Zbar: Basic Electricity	

TEXTBOOKS

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Georgia, Electronics, Phase C. Athens, GA: Vocational Education Materials Center.

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Heathkit Learning Publications, DC Electronics. Benton Harbor, MI: Heath Co., 1978.

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National Semi-Conductor Co., Linear Applications Handbook. Santa Clara, CA.

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Oleksy, Jerome E., Solid-State Electronics Laboratory Manual. Indianapolis, IN: Howard W. Sams and Co., Inc.

Philco Technical Representative Institute, Electronic Troubleshooting: A Self-Instructional Programmed Manual. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1966.

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STUDENT MANUALS

California State Department of Education, Sheet Metal Tools and Equipment Workbook.

Georgia, Microcomputer Concepts.

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Heathkit Learning Publications, Electronic Circuits, Student Workbook. Benton Harbor, MI: Heath Co.

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AUDIO VISUALS

Career Aids, Inc.	Filmstrips
Hobar Publications	Slide/tape, filmstrips
DCA Educational Products	Transparencies, 8 mm filmstrip
Bergwall Productions, Inc.	Filmstrips
Georgia Department of Education	Slide/tape
USAF, Aerospace Education Department	Video tapes
Sencore	Video tapes

Textbooks

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Wilson, J. and Glass, D., Study Guide for Journeyman CET Examinations. Indianapolis: Bobbs-Merrill, 1976.

ADDITIONAL INSTRUCTIONAL RESOURCES

Audio Visuals

American Red Cross (Contact your local unit.)	Films
Association - Sterling Films 866 Third Avenue New York, NY 10022	Films
Audio Visual Service Kent State University Kent, OH 44242	Films
A.V.C. Media Library Audiovisual Center University of Iowa Iowa City, IA 52240	Audio visuals
Bergwall Productions, Inc. 839 Stewart Avenue Garden City, NY 11530	Audio visuals
Center for Occupational Curriculum Development P.O. Box 7218 The University of Texas at Austin Austin, TX 78712	Audio visuals
Channel Master Motion Picture Division Ellenville, NY 12428	Films
DCA Educational Products 424 Valley Road Warrington, PA 18976	Audio visuals
Delmar Publishers 50 Wolf Road Albany, NY 12205	Audio visuals
Department of Audio-Visual Extention General Extension Division University of Minnesota 2037 University Ave. S.E. Minneapolis, MN 55455	Audio visuals

Department of Audio Visual Extension University of Minnesota 2037 University Avenue S.E. Minneapolis, MN 55455	Films
Digiac Division Digital Electronics Ames Court Plainview Long Island, NY 11803	Flip charts and transparency
Educational Film Library U.S. Naval Base Philadelphia, PA 19112	Films
Educators Progress Service, Inc. Randolph, WI 53956 "Educators Guide To Free Films"	Audio visuals (Free films)
Electronic Industries 43 West 61st. St. New York, NY 10023	Films
Fabri-Tek Educational 1261 South Boyle Ave. Los Angeles, CA	Transparencies and wall charts
Federal Aviation Administration Film Library, AC-44.5 P.O. Box 25082 Oklahoma City, OK 73125	Films
Film Bureau National Association of Manufactures 277 Park Avenue New York, NY 10017	Films
Georgia Power Film Library C/O Modern Talking Picture Service 4705-F Bakers Ferry Road, S.W. Atlanta, GA 30336 (404) 696-2025	Films
Instructional Materials Laboratory The Ohio State University Columbus, OH 43210	Audio visuals

Instructional Materials Laboratory 10 Industrial Educational Bldg. University of Missouri- Columbia Columbia, MO 65211	Audio visuals
Industrial Press, Inc. 200 Madison Avenue New York, NY 10057 (212) 889-6330	Audio visuals
Modern Talking Pictures Service C/O Film Programs, Inc. 2238 Euclid Ave. Cleveland, OH 44115	Films
3M Brand Visual Products Box 3100 St. Paul, MN 55101	Transparency
NASA Lewis Research Center Office of Educational Services 2100 Brookpark Rd. Cleveland, OH 44135	Films
National Society for Prevention of Blindness Public Information Department 79 Madison Avenue New York, NY 10016	Films
Popular Science Filmstrip of the Month 355 Lexington Avenue New York, NY 10017	Filmstrips
Prentice-Hall Media ServCode VD 3 150 White Plains Road Tarrytown, NY 10591	Filmstrips
Singer Society For Visual Education 1345 Diversey Parkway Chicago, IL 60614	Filmsprips and recordings
Serina Press 70 Kennedy Street Alexandria, VA 22305	Audio visuals (Free films)

Superior Electric Co. Media Manager 303 Middle St. Bristol, CN 06010	Films
Tectronics, Inc. Film Library Delivery Station 76-580 P.O. Box 500 Beaverton, OR 97005	Films
U.S. Army Visual Support Center Annville, PA 17003	Films
United Transparencies, Inc. P.O. Box 688 Binghampton, NY 13902	Transparency
Visual Aids Service Division University Extension University of Illinois Champaign, IL 61820	Audio visuals
Visual Aids Service University of Illinois Division of University Extension Champaign, IL 61820	Films
Vocational Instructional Services Texas A & M University College Station, TX 77843	Audio visuals
Vocational-Technical Curriculum Laboratory Rutgers-The State University Bldg. 4103-Kilmer Campus New Brunswic, NJ 08903	Audio visuals
Wisconsin Vocational Studies Center University of Wisconsin-Madison 964 Educational Services Bldg. 1025 W. Johnson St. Madison, WI 53706	Audio visuals

RESOURCE ADDRESSES

AAVIM
120 Engineering Center
Athens, GA 30602

American Tech
5608 Stony Island Avenue
Chicago, IL 60637

Bennett Publishing Company
809 W. Detweiller Drive
Department E 81
Peoria, IL 61615

Bergwall Productions, Inc.
839 Stewart Avenue
Garden City, NY 11530

Bishop Graphics, Inc.
Westlake Village, CA 94107

Bobbs-Merrill Educational
Publishing
Department No. 627
4300 West 62nd Street
P.O. Box 7080
Indianapolis, IN 46206

Buck Engineering Co.
Farmingdale, NJ 07727

CTI Education Products
Mt. Pleasant, SC 29464

California State Department
of Education
Bureau of Industrial
Education
721 Capitol Mall
Sacramento, CA 95814

Career Aids, Inc.
8950 Lurline Avenue
Department T. 76
Chatsworth, CA 91311

Charles A. Bennett Company,
Inc.
809 Detweiler Drive
Peoria, IL 61614

Delmar Publications
50 Wolf Road
Albany, NY 12205

Georgia Department of Education
Vocational Curriculum Center
3952 Shirley Drive
Atlanta, GA 30336

Georgia Office of Vocational
Education
Georgia Department of Education
Atlanta, GA 30334

Goodheart-Willcox Company
123 W. Taft Drive
South Holland, IL 60473

Gregg/McGraw-Hill
P.O. Box 996
Norcross, GA 30091

Heath Company
Benton Harbor, MI 49022

Hobar Publications
1234 Tiller Lane
St. Paul, MN 55112

McKnight Publishing Company
Box 2854
Bloomington, IL 61707

Mid-America Vocational
Curriculum Consortium (MAVCC)
1515 West Sixth Avenue
Stillwater, OK 74074

National Semi-Conductor Co.
2900 Semi-Conductor Drive
Santa Clara, CA 95051

National Training Aids, Inc.
Manual Division "M"
P.O. Box 565
Norcross, GA 30091

Newnes Technical Books
Butterworth Publishing, Inc.
19 Cummings Park
Woburn, MA 01801

Prentice-Hall Media
ServCode VD3
150 White Plains Road
Tarrytown, NY 10591

Quasar Electronics Corp.
Technical Training Systems
Atlanta, GA 30303

Singer Career Systems
80 Commerce Drive
Rochester, NY 14623

(The) Superintendent of Documents
United States Government Printing Office
Washington, DC 20402

Technical Publishing Co.
Barrington, IL 60010

Training Technology, Inc.
(See Vocational Curriculum Center)

Vocational Education Materials Center
Green Street
The University of Georgia
Athens, GA 30602

SECTION VII

STUDENT RECORDS

STUDENT RECORDS

This section contains four forms, the Individual Progress Report Chart, the Group Progress Chart, the Competency Checklist and the Certificate of Competency. The use of these Charts is described below and on page 6.

INDIVIDUAL PROGRESS REPORT

One copy should be kept in each student's confidential file and updated as tasks are completed. Grades should be assigned upon task completion and then averaged for grade reporting. Difficulty, excessive amounts of time, etc. should be noted on this form and should be discussed with the student.

GROUP PROGRESS CHART

This chart reflects task completion only and can be displayed in the classroom or lab area. Due to confidentiality of records, a grade must not be recorded. The instructor should maintain a copy of this record and update it daily.

INDIVIDUAL PROGRESS REPORT

NAME ______________________________

PROGRAM/ CLUSTER __________________________ AREA __________________________

TASK/ UNIT NO.	UNIT TITLE	DATE STARTED	DATE COMP.	EST. TIME	GRADE

GROUP PROGRESS CHART

NAME	UNITS/TASKS																				

COMPETENCY CHECKLIST

The Competency Checklist is an easy device for the instructor to use to know when a student is eligible to receive a Certificate of Competency (shown on page 11). One Checklist is used per student for as long as the student stays in the program. The instructor may use the checklist in the following manner:

1. Enter the student's name on the form.
2. As the student masters each task, check-off the task under each job title on the Competency Checklist for which it appears.
3. Keep the Checklist in each student's personal file or keep all Competency Checklists together in a separate file.
4. When all the tasks underneath a job title have been checked-off, the student is eligible to receive a Certificate of Competency for that job title.

CERTIFICATE OF COMPETENCY

The Certificate of Competency is issued by the instructor to certify that the student has mastered the tasks necessary for entry level employment for the job listed on the Certificate. The specific tasks that have been mastered are printed on the back of the Certificate, which can be used by the student to show a prospective employer exactly what the student is qualified to do. The Certificates should be printed ahead of time so that the instructor may simply fill in the front of the Certificate whenever a student is eligible to receive one, as indicated by the student's Competency Checklist. A sample completed Certificate of Competency appears on page followed by a Certificate of Competency for each of the possible Electronic Technology program exit points (job titles).

The Certificate should be completed by the instructor as follows:

1. Enter the student's name.
2. Enter the school name.
3. Date and sign the Certificate.
4. It is recommended that the Certificate be stamped with the school seal.

COMPETENCY CHECKLIST

____
Student Name

As the student masters each unit of instruction, check off the unit number under each of the following job titles where it appears. When all the units under a job title have been completed, the student is eligible to receive a Certificate of Competency for that job title.

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729.281-018

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Electronics Assembler
726.684-018

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Electronics Utility Worker
726.361-010

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Electronics Tester II
726.684-026

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Production Repairer
726.381-014

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Assembly Technician (Computer)
633.261-010

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Electronics Tester I
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Radio Mechanic
823.261-018

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Electronics Technician
003.161-014

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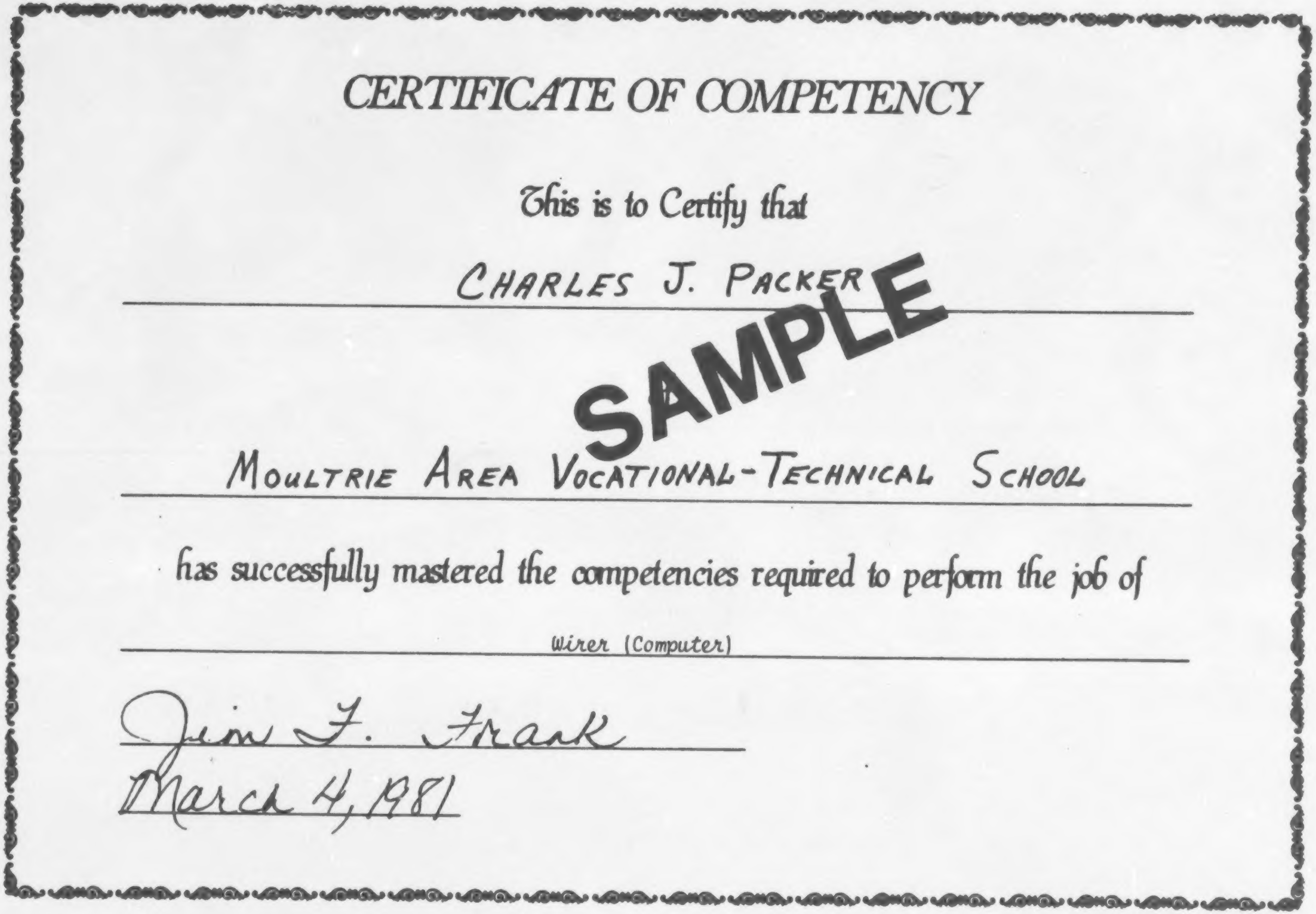

CERTIFICATE OF COMPETENCY

This is to Certify that

CHARLES J. PACKER

SAMPLE

MOULTRIE AREA VOCATIONAL-TECHNICAL SCHOOL

has successfully mastered the competencies required to perform the job of

Wirer (Computer)

Jim F. Frank

March 4, 1981

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Wirer (Computer).

WIRER (COMPUTER)
729.281-018

Observing electrical safety precautions
Identifying and using hand tools
Identifying and using sheet metal tools
Identifying and using power tools
Identifying and using volt-ohm milliammeters (VOM)
Identifying and using electronic-volt meters (EVM)
Identifying and using ohmmeters
Identifying and using oscilloscopes
Identifying and using tube testers
Identifying and using transistor analyzers
Identifying and using capacitor testers
Identifying and using sine wave generators
Identifying and using signal generators
Identifying and using pulse generators
Identifying and using square wave generators
Identifying and using impedance testers
Identifying and using frequency meters
Performing visual inspection of electronic equipment
Cleaning electronic equipment
Lubricating electronic equipment
Inspecting and replacing cords and cables
Inspecting and replacing tubes
Inspecting and replacing transistors
Inspecting and replacing IC units
Inspecting and replacing PC boards
Inspecting and repairing loudspeakers
Inspecting and repairing microphones

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

Wirer (Computer)

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The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Wirer (Computer).

WIRER (COMPUTER)
729.281-018

Observing electrical safety precautions
Identifying and using hand tools
Identifying and using sheet metal tools
Identifying and using power tools
Identifying and using volt-ohm milliammeters (VOM)
Identifying and using electronic-volt meters (EVM)
Identifying and using ohmmeters
Identifying and using oscilloscopes
Identifying and using tube testers
Identifying and using transistor analyzers
Identifying and using capacitor testers
Identifying and using sine wave generators
Identifying and using signal generators
Identifying and using pulse generators
Identifying and using square wave generators
Identifying and using impedance testers
Identifying and using frequency meters
Performing visual inspection of electronic equipment
Cleaning electronic equipment
Lubricating electronic equipment
Inspecting and replacing cords and cables
Inspecting and replacing tubes
Inspecting and replacing transistors
Inspecting and replacing IC units
Inspecting and replacing PC boards
Inspecting and repairing loudspeakers
Inspecting and repairing microphones

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

Electronics Assembler

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The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Electronics Assembler.

ELECTRONICS ASSEMBLER
726.684-018

Observing electrical safety precautions
Identifying and using hand tools
Identifying and using sheet metal tools
Identifying and using power tools
Identifying and using volt-ohm-milliammeters (VOM)
Identifying and using electronic-volt meters (EVM)
Identifying and using ohmmeters
Identifying and using oscilloscopes
Identifying and using tube testers
Identifying and using transistor analyzes
Identifying and using capacitor testers
Identifying and using sine wave generators
Identifying and using signal generators
Identifying and using pulse generators
Identifying and using square wave generators
Identifying and using impedance testers
Identifying and using frequency meters
Understanding fundamentals of electrical theory and electrical measurement
Making calculations using Ohm's law
Measuring current in DC circuits
Measuring voltage in DC circuits
Calculating and measuring resistance in DC circuits
Calculating voltage, current and resistance in DC series circuits
Calculating total voltage, total current and total resistance in DC parallel circuits
Calculating and measuring electrical quantities in combination DC circuits
Calculating power in DC circuits
Applying fundamentals of magnetism and electromagnetism
Using test instruments to measure voltage, current and resistance
Calculating values in DC network circuits
Calculating capacitance and time constants for RC circuits
Calculating values for a right triangle
Identifying the characteristics of AC sine waves
Measuring AC values for LF circuits
Determining reactance and impedance of a capacitor in either series or parallel circuits
Calculating and measuring electrical values in DC capacitance circuits
Measuring inductance in series DC circuits
Computing turns, voltage, current and impedance ratios of transformers
Drawing phasor diagrams and calculating operating values for series AC circuits
Drawing phasor diagrams and calculating operating values for parallel AC circuits
Understanding fundamentals of tuned AC circuits
Understanding fundamentals of semi-conductor materials
Performing a condition test of a semi-conductor diode using an ohmmeter
Performing a condition test of zener diodes used in regulator circuits
Identifying symbols and electrical characteristics of tunnel, varactor and high frequency diodes
Understanding the fundamentals of bipolar transistors and their electrical characteristics
Performing condition tests of bipolar transistors
Understanding the fundamentals of field effect transistors and their electrical characteristics
Understanding the fundamentals of thyristors and their electrical characteristics
Understanding fundamentals of integrated circuits
Defining the operating values and applications of optoelectronic devices
Identifying the component parts and operational characteristics of diode vacuum tubes
Identifying the component parts and operating characteristics of triode vacuum tubes
Identifying the component parts and operating characteristics of tetrode vacuum tubes
Identifying the component parts and operating characteristics of pentode vacuum tubes
Performing visual inspection of electronic equipment
Cleaning electronic equipment
Lubricating electronic equipment
Inspecting and replacing cords and cables
Inspecting and replacing tubes
Inspecting and replacing transistors
Inspecting and replacing IC units
Inspecting and replacing PC boards
Inspecting and repairing loudspeakers
Inspecting and repairing microphones

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

Electronics Utility Worker

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The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Electronics Utility Worker.

ELECTRONICS UTILITY WORKER
726.361-010

Observing electrical safety precautions
Identifying and using hand tools
Identifying and using sheet metal tools
Identifying and using power tools
Identifying and using volt-ohm-milliammeters (VOM)
Identifying and using electronic-volt meters (EVM)
Identifying and using ohmmeters
Identifying and using oscilloscopes
Identifying and using tube testers
Identifying and using transistor analyzers
Identifying and using capacitor testers
Identifying and using sine wave generators
Identifying and using signal generators
Identifying and using pulse generators
Identifying and using square wave generators
Identifying and using impedance testers
Identifying and using frequency meters
Understanding fundamentals of electrical theory and electrical measurement
Making calculations using Ohm's law
Measuring current in DC circuits
Measuring voltage in DC circuits
Calculating and measuring resistance in DC circuits
Calculating voltage, current and resistance in DC series circuits
Calculating total voltage, total current and total resistance in DC parallel circuits
Calculating and measuring electrical quantities in combination DC circuits
Calculating power in DC circuits
Applying fundamentals of magnetism and electromagnetism
Using test instruments to measure voltage, current and resistance
Calculating values in DC network circuits
Calculating capacitance and time constants for RC circuits
Calculating values for a right triangle
Identifying the characteristics of AC sine waves
Measuring AC values for LF circuits .
Determining reactance and impedance of a capacitor in either series or parallel circuits
Calculating and measuring electrical values in AC capacitance circuits
Measuring inductance in series RL circuits
Computing turns, voltage, current and impedance ratios of transformers
Drawing phasor diagrams and calculating operating values for series AC circuits
Drawing phasor diagrams and calculating operating values for parallel AC circuits
Understanding fundamentals of tuned AC circuits
Understanding fundamentals of semi-conductor materials
Performing a condition test of a semi-conductor diode using an ohmmeter
Performing a condition test of zener diodes used in regulator circuits
Identifying symbols and electrical characteristics of tunnel, varactor and high frequency diodes
Understanding the fundamentals of bipolar transistors and their electrical characteristics
Performing condition tests of bipolar transistors
Understanding the fundamentals of field effect transistors and their electrical characteristics
Understanding the fundamentals of thyristors and their electrical characteristics
Understanding fundamentals of integrated circuits
Defining the operating values and applications of optoelectronic devices
Identifying the component parts and operational characteristics of diode vacuum tubes
Identifying the component parts and operating characteristics of triode vacuum tubes
Identifying the component parts and operating characteristics of tetrode vacuum tubes
Identifying the component parts and operating characteristics of pentode vacuum tubes

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

Electronics Tester II

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The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Electronics Tester II.

ELECTRONICS TESTER II
726.684-026

Observing electrical safety precautions
Identifying and using hand tools
Identifying and using sheet metal tools
Identifying and using power tools
Identifying and using volt-ohm-milliammeters (VOM)
Identifying and using electronic-volt meters (EVM)
Identifying and using ohmmeters
Identifying and using oscilloscopes
Identifying and using tube testers
Identifying and using transistor analyzers
Identifying and using capacitor testers
Identifying and using sine wave generators
Identifying and using signal generators
Identifying and using pulse generators
Identifying and using square wave generators
Identifying and using impedance testers
Identifying and using frequency meters
Understanding fundamentals of electrical theory and electrical measurement
Making calculations using Ohm's law
Measuring current in DC circuits
Measuring voltage in DC circuits
Calculating and measuring resistance in DC circuits
Calculating voltage, current and resistance in DC series circuits
Calculating total voltage, total current and total resistance in DC parallel circuits
Calculating and measuring electrical quantities in combination DC circuits
Calculating power in DC circuits
Applying fundamentals of magnetism and electromagnetism
Using test instruments to measure voltage, current and resistance
Calculating values in DC network circuits
Calculating capacitance and time constants for RC circuits
Calculating values for a right triangle
Identifying the characteristics of AC sine waves
Defining electrical characteristics, applications and normal operational values of amplifiers
Testing an amplifier for amplification
Testing and repairing a vacuum tube amplifier
Testing and repairing a transistor amplifier
Identifying component parts and electrical characteristics of power supply circuits
Testing and repairing power supplies
Calibrating power supply voltage
Constructing and performing a condition test of oscillators
Testing and repairing oscillators
Testing and repairing clampers
Testing and repairing clipper circuits
Testing and repairing counters
Constructing and performing condition tests of pulse circuits
Testing and repairing nonsinusoidal wave shape amplifiers
Identifying electrical characteristics and operating values of amplitude modulators (AM) and AM detectors
Identifying electrical characteristics and operating values of frequency modulators (FM) and FM detectors
Constructing and performing condition testing of superheterodyne receivers
Identifying sequence and electrical characteristics of television signal development, transmission, reception and decoding
Identifying the components and electrical characteristics of a low voltage power supply and its protective circuit
Performing condition testing on a low voltage power supply
Troubleshooting a defective switch-mode secondary voltage supply
Troubleshooting defective synchronizing and deflection circuits
Troubleshooting defective horizontal output circuits
Troubleshooting sweep generator circuits
Troubleshooting a defective high voltage supply
Troubleshooting electronic circuits
Performing physical and electrical alignment of the picture tube and its associated circuits

Measuring AC values for LF circuits
Determining reactance and impedance of a capacitor in either series or parallel circuits
Calculating and measuring electrical values in AC capacitance circuits
Measuring inductance in series RL circuits
Computing turns, voltage, current and impedance ratios of transformers
Drawing phasor diagrams and calculating operating values for series AC circuits
Drawing phasor diagrams and calculating operating values for parallel AC circuits
Understanding fundamentals of tuned AC circuits
Understanding fundamentals of semi-conductor materials
Performing a condition test of a semi-conductor diode using an ohmmeter
Performing a condition test of zener diodes used in regulator circuit
Identifying symbols and electrical characteristics of tunnel, varactor and high frequency diodes
Understanding the fundamentals of bipolar transistors and their electrical characteristics
Performing condition tests of bipolar transistors
Understanding the fundamentals of field effect transistors and their electrical characteristics
Understanding the fundamentals of thyristors and their electrical characteristics
Understanding fundamentals of integrated circuits
Defining the operating values and applications of optoelectronic devices
Identifying the component parts and operational characteristics of diode vacuum tubes
Identifying the component parts and operating characteristics of triode vacuum tubes
Identifying the component parts and operating characteristics of tetrode vacuum tubes
Identifying the component parts and operating characteristics of pentode vacuum tubes
Performing condition testing of the thermal stability and operational parameters of a common-emitter amplifier circuit
Performing condition testing of DC and audio amplifiers

Troubleshooting a defective vertical deflection circuit
Adjusting circuit operational conditions to obtain proper purity, focus and gray scale
Identifying terms and definitions used to describe the components and operational characteristics of video amplifiers
Troubleshooting defective video amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of video IF amplifiers
Performing condition testing and aligning to specifications RF and IF amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of sound IF and AM circuits
Performing condition testing and aligning to specifications the sound IF and AM circuits
Identifying terms and definitions used to describe the components and operational characteristics of VHF and UHF tuner circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic fine tuning (AFT) and remote control circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic gain control (AGC) and noise cancelling circuits
Identifying terms and definitions used to describe the components and operational characteristics of color television signal development, transmission, reception and decoding
Performing a condition test of a picture tube and its associated circuits
Identifying terms and definitions used to describe components and operational characteristics of band-pass amplifiers and circuits
Identifying terms and definitions used to describe the components and operational characteristics of color sync circuits
Identifying terms and definitions used to describe the components and operational characteristics of color demodulator and output amplifier circuits
Troubleshooting defective color tuning circuits
Performing condition testing and aligning to specifications color convergence circuits

CERTIFICATE OF COMPETENCY

This is to Certify that

of

has successfully mastered the competencies required to perform the job of

Production Repairer

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Production Repairer.

PRODUCTION REPAIRER
726.381-014

Observing electrical safety precautions
Identifying and using hand tools
Identifying and using sheet metal tools
Identifying and using power tools
Identifying and using volt-ohm-milliammeters (VOM)
Identifying and using electronic-volt meters (EVM)
Identifying and using ohmmeters
Identifying and using oscilloscopes
Identifying and using tube testers
Identifying and using transistor analyzers
Identifying and using capacitor testers
Identifying and using sine wave generators
Identifying and using signal generators
Identifying and using pulse generators
Identifying and using square wave generators
Identifying and using impedance testers
Identifying and using frequency meters
Understanding fundamentals of electrical theory and electrical measurement
Making calculations using Ohm's law
Measuring current in DC circuits
Measuring voltage in DC circuits
Calculating and measuring resistance in DC circuits
Calculating voltage, current and resistance in DC series circuits
Calculating total voltage, total current and total resistance in DC parallel circuits
Calculating and measuring electrical quantities in combination DC circuits

Applying fundamentals of magnetism and electromagnetism
Using test instruments to measure voltage, current and resistance
Calculating values in DC network circuits
Calculating capacitance and time constants for RC circuits
Calculating values for a right triangle
Identifying the characteristics of AC sine waves
Measuring AC values for LF circuits

Testing and repairing a transistor amplifier
Identifying component parts and electrical characteristics of power supply circuits
Testing and repairing power supplies
Calibrating power supply voltage
Constructing and performing a condition test of oscillators
Testing and repairing oscillators
Testing and repairing clampers
Testing and repairing clipper circuits
Testing and repairing counters
Constructing and performing condition tests of pulse circuits
Testing and repairing nonsinusoidal wave shape amplifiers
Identifying electrical characteristics and operating values of amplitude modulators (AM) and AM detectors
Identifying electrical characteristics and operating values of frequency modulators (FM) and FM detectors
Constructing and performing condition testing of superheterodyne receivers
Identifying sequence and electrical characteristics of television signal development, transmission, reception and decoding
Identifying the components and electrical characteristics of a low voltage power supply and its protective circuit
Performing condition testing on a low voltage power supply
Troubleshooting a defective switch-mode secondary voltage supply
Troubleshooting defective synchronizing and deflection circuits
Troubleshooting defective horizontal output circuits
Troubleshooting sweep generator circuits
Troubleshooting a defective high voltage supply
Troubleshooting electronic circuits
Performing physical and electrical alignment of the picture tube and its associated circuits
Troubleshooting a defective vertical deflection circuit
Adjusting circuit operational conditions to obtain proper purity, focus and gray scale
Identifying terms and definitions used to describe the components and operational characteristics of video amplifiers

Determining reactance and impedance of a capacitor in either series or parallel circuits
Calculating and measuring electrical values in AC capacitance circuits
Measuring inductance in series RL circuits
Computing turns, voltage, current and impedance ratios of transformers
Drawing phasor diagrams and calculating operating values for series AC circuits
Drawing phasor diagrams and calculating operating values for parallel DC circuits
Understanding fundamentals of tuned AC circuits
Understanding fundamentals of semi-conductor materials
Performing a condition test of a semi-conductor diode using an ohmmeter
Performing a condition test of zener diodes used in regulator circuits
Identifying symbols and electrical characteristics of tunnel, varactor and high frequency diodes
Understanding the fundamentals of bipolar transistors and their electrical characteristics
Performing condition tests of bipolar transistors
Understanding the fundamentals of field effect transistors and their electrical characteristics
Understanding the fundamentals of thyristors and their electrical characteristics
Understanding fundamentals of integrated circuits
Defining the operating values and applications of optoelectronic devices
Identifying the component parts and operational characteristics of diode vacuum tubes
Identifying the component parts and operating characteristics of triode vacuum tubes
Identifying the component parts and operating characteristics of tetrode vacuum tubes
Identifying the component parts and operating characteristics of pentode vacuum tubes
Performing condition testing of the thermal stability and operational parameters of a common-emitter amplifier circuit
Performing condition testing of DC and audio amplifiers
Defining electrical characteristics, applications and normal operational values of amplifiers
Testing an amplifier for amplification
Testing and repairing a vacuum tube amplifier

Troubleshooting defective video amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of video IF amplifiers
Performing condition testing and aligning to specifications RF and IF amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of sound IF and AM circuits
Performing condition testing and aligning to specifications the sound IF and AM circuits
Identifying terms and definitions used to describe the components and operational characteristics of VHF and UHF tuner circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic fine tuning (AFT) and remote control circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic gain control (AGC) and noise concelling circuits
Identifying terms and definitions used to describe the components and operational characteristics of color television signal development, transmission, reception and decoding
Performing a condition test of a picture tube and its associated circuits
Identifying terms and definitions used to describe components and operational characteristics of band-pass amplifiers and circuits
Identifying terms and definitions used to describe the components and operational characteristics of color sync circuits
Identifying terms and definitions used to describe the components and operational characteristics of color demodulator and output amplifier circuits
Troubleshooting defective color tuning circuits
Performing condition testing and aligning to specifications color convergence circuits
Performing visual inspection of electronic equipment
Cleaning electronic equipment
Lubricating electronic equipment
Inspecting and replacing cords and cables
Inspecting and replacing tubes
Inspecting and replacing transistors
Inspecting and replacing IC units
Inspecting and replacing PC boards
Inspecting and repairing loudspeakers
Inspecting and repairing microphones

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

Assembly Technician (Computer)

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The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Assembly Technician (Computer).

ASSEMBLY TECHNICIAN (COMPUTER)
633.261-010

Observing electrical safety precautions
Identifying and using hand tools
Identifying and using sheet metal tools
Identifying and using power tools
Identifying and using volt-ohm-milliammeters (VOM)
Identifying and using electronic-volt meters (EVM)
Identifying and using ohmmeters
Identifying and using oscilloscopes
Identifying and using tube testers
Identifying and using transistor analyzers
Identifying and using capacitor testers
Identifying and using sine wave generators
Identifying and using signal generators
Identifying and using pulse generators
Identifying and using square wave generators
Identifying and using impedance testers
Identifying and using frequency meters
Understanding fundamentals of electrical theory and electrical measurement
Making calculations using Ohm's law
Measuring current in DC circuits
Measuring voltage in DC circuits
Calculating and measuring resistance in DC circuits
Calculating voltage, current and resistance in DC series circuits
Calculating total voltage, total current and total resistance in DC parallel circuits
Calculating and measuring electrical quantities in combination DC circuits
Calculating power in DC circuits
Applying fundamentals of magnetism and electromagnetism
Using test instruments to measure voltage, current and resistance
Calculating values in DC network circuits
Calculating capacitance and time constants for RC circuits
Calculating values for a right triangle
Identifying the characteristics of AC sine waves
Measuring AC values for LF circuits
Testing and repairing a transistor amplifier
Identifying component parts and electrical characteristics of power supply circuits
Testing and repairing power supplies
Calibrating power supply voltage
Constructing and performing a condition test of oscillators
Testing and repairing oscillators
Testing and repairing clampers
Testing and repairing clipper circuits
Testing and repairing counters
Constructing and performing condition tests of pulse circuits
Testing and repairing nonsinusoidal wave shape amplifiers
Identifying electrical characteristics and operating values of amplitude modulators (AM) and AM detectors
Identifying electrical characteristics and operating values of frequency modulators (FM) and FM detectors
Constructing and performing condition testing of superheterodyne receivers
Identifying sequence and electrical characteristics of television signal development, transmission, reception and decoding
Identifying the components and electrical characteristics of a low voltage power supply and its protective circuit
Performing condition testing on a low voltage power supply
Troubleshooting a defective switch-mode secondary voltage supply
Troubleshooting defective synchronizing and deflection circuits
Troubleshooting defective horizontal output circuits
Troubleshooting sweep generator circuits
Troubleshooting a defective high voltage supply
Troubleshooting electronic circuits
Performing physical and electrical alignment of the picture tube and its associated circuits
Troubleshooting a defective vertical deflection circuit
Adjusting circuit operational conditions to obtain proper purity, focus and gray scale
Identifying terms and definitions used to describe the components and operational characteristics of video amplifiers

Determining reactance and impedance of a capacitor in either series or parallel circuits
Calculating and measuring electrical values in AC capacitance circuits
Measuring inductance in series RL circuits
Computing turns, voltage, current and impedance ratios of transformers
Drawing phasor diagrams and calculating operating values for series AC circuits
Drawing phasor diagrams and calculating operating values for parallel DC circuits
Understanding fundamentals of tuned AC circuits
Understanding fundamentals of semi-conductor materials
Performing a condition test of a semi-conductor diode using an ohmmeter
Performing a condition test of zener diodes used in regulator circuits
Identifying symbols and electrical characteristics of tunnel, varactor and high frequency diodes
Understanding the fundamentals of bipolar transistors and their electrical characteristics
Performing condition tests of bipolar transistors
Understanding the fundamentals of field effect transistors and their electrical characteristics
Understanding the fundamentals of thyristors and their electrical characteristics
Understanding fundamentals of integrated circuits
Defining the operating values and applications of optoelectronic devices
Identifying the component parts and operational characteristics of diode vacuum tubes
Identifying the component parts and operating characteristics of triode vacuum tubes
Identifying the component parts and operating characteristics of tetrode vacuum tubes
Identifying the component parts and operating characteristics of pentode vacuum tubes
Performing condition testing of the thermal stability and operational parameters of a common-emitter amplifier circuit
Performing condition testing of DC and audio amplifiers
Defining electrical characteristics, applications and normal operational values of amplifiers
Testing an amplifier for amplification
Testing and repairing a vacuum tube amplifier

Troubleshooting defective video amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of video IF amplifiers
Performing condition testing and aligning to specifications RF and IF amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of sound IF and AM circuits
Performing condition testing and aligning to specifications the sound IF and AM circuits
Identifying terms and definitions used to describe the components and operational characteristics of VHF and UHF tuner circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic fine tuning (AFT) and remote control circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic gain control (AGC) and noise concelling circuits
Identifying terms and definitions used to describe the components and operational characteristics of color television signal development, transmission, reception and decoding
Performing a condition test of a picture tube and its associated circuits
Identifying terms and definitions used to describe components and operational characteristics of band-pass amplifiers and circuits
Identifying terms and definitions used to describe the components and operational characteristics of color sync circuits
Identifying terms and definitions used to describe the components and operational characteristics of color demodulator and output amplifier circuits
Troubleshooting defective color tuning circuits
Performing condition testing and aligning to specifications color convergence circuits
Performing visual inspection of electronic equipment
Cleaning electronic equipment
Lubricating electronic equipment
Inspecting and replacing cords and cables
Inspecting and replacing tubes
Inspecting and replacing transistors
Inspecting and replacing IC units
Inspecting and replacing PC boards
Inspecting and repairing loudspeakers
Inspecting and repairing microphones

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

Radiotelephone Operator

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The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Radiotelephone Operator.

RADIOTELEPHONE OPERATOR
193.262-034

Observing electrical safety precautions
Identifying and using hand tools
Identifying and using sheet metal tools
Identifying and using power tools
Identifying and using volt-ohm-milliammeters (VOM)
Identifying and using electronic-volt meters (EVM)
Identifying and using ohmmeters
Identifying and using oscilloscopes
Identifying and using tube testers
Identifying and using transistor analyzers
Identifying and using capacitor testers
Identifying and using sine wave generators
Identifying and using signal generators
Identifying and using pulse generators
Identifying and using square wave generators
Identifying and using impedance testers
Identifying and using frequency meters
Understanding fundamentals of electrical theory and electrical measurement
Making calculations using Ohm's law
Measuring current in DC circuits
Measuring voltage in DC circuits
Calculating and measuring resistance in DC circuits
Calculating voltage, current and resistance in DC series circuits
Calculating total voltage, total current and total resistance in DC parallel circuits
Calculating and measuring electrical quantities in combination DC circuits
Calculating power in DC circuits
Applying fundamentals of magnetism and electromagnetism
Using test instruments to measure voltage, current and resistance
Calculating values in DC network circuits
Calculating capacitance and time constants for RC circuits
Calculating values for a right triangle
Identifying the characteristics of AC sine waves
Measuring AC values for LF circuits
Testing and repairing a transistor amplifier
Identifying component parts and electrical characteristics of power supply circuits
Testing and repairing power supplies
Calibrating power supply voltage
Constructing and performing a condition test of oscillators
Testing and repairing oscillators
Testing and repairing clampers
Testing and repairing clipper circuits
Testing and repairing counters
Constructing and performing condition tests of pulse circuits
Testing and repairing nonsinusoidal wave shape amplifiers
Identifying electrical characteristics and operating values of amplitude modulators (AM) and AM detectors
Identifying electrical characteristics and operating values of frequency modulators (FM) and FM detectors
Constructing and performing condition testing of superheterodyne receivers
Identifying sequence and electrical characteristics of television signal development, transmission, reception and decoding
Identifying the components and electrical characteristics of a low voltage power supply and its protective circuit
Performing condition testing on a low voltage power supply
Troubleshooting a defective switch-mode secondary voltage supply
Troubleshooting defective synchronizing and deflection circuits
Troubleshooting defective horizontal output circuits
Troubleshooting sweep generator circuits
Troubleshooting a defective high voltage supply
Troubleshooting electronic circuits
Performing physical and electrical alignment of the picture tube and its associated circuits
Troubleshooting a defective vertical deflection circuit
Adjusting circuit operational conditions to obtain proper purity, focus and gray scale
Identifying terms and definitions used to describe the components and operational characteristics of video amplifiers

Determining reactance and impedance of a capacitor in either series or parallel circuits
Calculating and measuring electrical values in AC capacitance circuits
Measuring inductance in series RL circuits
Computing turns, voltage, current and impedance ratios of transformers
Drawing phasor diagrams and calculating operating values for series AC circuits
Drawing phasor diagrams and calculating operating values for parallel DC circuits
Understanding fundamentals of tuned AC circuits
Understanding fundamentals of semi-conductor materials
Performing a condition test of a semi-conductor diode using an ohmmeter
Performing a condition test of zener diodes used in regulator circuits
Identifying symbols and electrical characteristics of tunnel, varactor and high frequency diodes
Understanding the fundamentals of bipolar transistors and their electrical characteristics
Performing condition tests of bipolar transistors
Understanding the fundamentals of field effect transistors and their electrical characteristics
Understanding the fundamentals of thyristors and their electrical characteristics
Understanding fundamentals of integrated circuits
Defining the operating values and applications of optoelectronic devices
Identifying the component parts and operational characteristics of diode vacuum tubes
Identifying the component parts and operating characteristics of triode vacuum tubes
Identifying the component parts and operating characteristics of tetrode vacuum tubes
Identifying the component parts and operating characteristics of pentode vacuum tubes
Performing condition testing of the thermal stability and operational parameters of a common-emitter amplifier circuit
Performing condition testing of DC and audio amplifiers
Defining electrical characteristics, applications and normal operational values of amplifiers
Testing an amplifier for amplification
Testing and repairing a vacuum tube amplifier

Troubleshooting defective video amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of video IF amplifiers
Performing condition testing and aligning to specifications RF and IF amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of sound IF and AM circuits
Performing condition testing and aligning to specifications the sound IF and AM circuits
Identifying terms and definitions used to describe the components and operational characteristics of VHF and UHF tuner circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic fine tuning (AFT) and remote control circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic gain control (AGC) and noise concelling circuits
Identifying terms and definitions used to describe the components and operational characteristics of color television signal development, transmission, reception and decoding
Performing a condition test of a picture tube and its associated circuits
Identifying terms and definitions used to describe components and operational characteristics of band-pass amplifiers and circuits
Identifying terms and definitions used to describe the components and operational characteristics of color sync circuits
Identifying terms and definitions used to describe the components and operational characteristics of color demodulator and output amplifier circuits
Troubleshooting defective color tuning circuits
Performing condition testing and aligning to specifications color convergence circuits
Performing visual inspection of electronic equipment
Cleaning electronic equipment
Lubricating electronic equipment
Inspecting and replacing cords and cables
Inspecting and replacing tubes
Inspecting and replacing transistors
Inspecting and replacing IC units
Inspecting and replacing PC boards
Inspecting and repairing loudspeakers
Inspecting and repairing microphones

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

Electronics Tester I

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The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Electronics Tester I.

ELECTRONICS TESTER I
726.281-014

Observing electrical safety precautions
Identifying and using hand tools
Identifying and using sheet metal tools
Identifying and using power tools
Identifying and using volt-ohm-milliammeters (VOM)
Identifying and using electronic-volt meters (EVM)
Identifying and using ohmmeters
Identifying and using oscilloscopes
Identifying and using tube testers
Identifying and using transistor analyzers
Identifying and using capacitor testers
Identifying and using sine wave generators
Identifying and using signal generators
Identifying and using pulse generators
Identifying and using square wave generators
Identifying and using impedance testers
Identifying and using frequency meters
Understanding fundamentals of electrical theory and electrical measurement
Making calculations using Ohm's law
Measuring current in DC circuits
Measuring voltage in DC circuits
Calculating and measuring resistance in DC circuits
Calculating voltage, current and resistance in DC series circuits
Calculating total voltage, total current and total resistance in DC parallel circuits
Calculating and measuring electrical quantities in combination DC circuits
Calculating power in DC circuits
Applying fundamentals of magnetism and electromagnetism
Using test instruments to measure voltage, current and resistance
Calculating values in DC network circuits
Calculating capacitance and time constants for RC circuits
Calculating values for a right triangle
Identifying the characteristics of AC sine waves
Measuring AC values for LF circuits
Determining reactance and impedance of a capacitor in either series or parallel circuits
Testing and repairing power supplies
Calibrating power supply voltage
Constructing and performing a condition test of oscillators
Testing and repairing oscillators
Testing and repairing clampers
Testing and repairing clipper circuits
Testing and repairing counters
Constructing and performing condition tests of pulse circuits
Testing and repairing nonsinusoidal wave shape amplifiers
Identifying electrical characteristics and operating values of amplitude modulators (AM) and AM detectors
Identifying electrical characteristics and operating values of frequency modulators (FM) and FM detectors
Constructing and performing condition testing of superheterodyne receivers
Identiyfing sequence and electrical characteristics of television signal development, transmission, reception and decoding
Identifying the components and electrical characteristics of a low voltage power supply and its protective circuit
Performing condition testing on a low voltage power supply
Troubleshooting a defective switch-mode secondary voltage supply
Troubleshooting defective synchronizing and deflection circuits
Troubleshooting defective horizontal output circuits
Troubleshooting sweep generator circuits
Troubleshooting a defective high voltage supply
Troubleshooting electronic circuits
Performing physical and electrical alignment of the picture tube and its associated circuits
Troubleshooting a defective vertical deflection circuit
Adjusting circuit operational conditions to obtain proper purity, focus and gray scale
Identifying terms and definitions used to describe the components and operational characteristics of video amplifiers
Troubleshooting defective video amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of video IF amplifiers
Performing condition testing and aligning to specifications RF and IF amplifiers

- Calculating and measuring electrical values in AC capacitance circuits
- Measuring inductance in series RL circuits
- Computing turns, voltage, current and impedance ratios of transformers
- Drawing phasor diagrams and calculating operating values for series AC circuits
- Drawing phasor diagrams and calculating operating values for parallel AC circuits
- Understanding fundamentals of tuned AC circuits
- Understanding fundamentals of semi-conductor materials
- Performing a condition test of a semi-conductor diode using an ohmmeter
- Performing a condition test of zener diodes used in regulator circuits
- Identifying symbols and electrical characteristics of tunnel, varactor, and high frequency diodes
- Understanding the fundamentals of bipolar transistors and their electrical characteristics
- Performing condition tests of bipolar transistors
- Understanding the fundamentals of field effect transistors and their electrical characteristics
- Understanding the fundamentals of thyristors and their electrical characteristics
- Understanding fundamentals of integrated circuits
- Defining the operating values and applications of optoelectronic devices
- Identifying the component parts and operational characteristics of diode vacuum tubes
- Identifying the component parts and operating characteristics of triode vacuum tubes
- Identifying the component parts and operating characteristics of tetrode vacuum tubes
- Identifying the component parts and operating characteristics of pentode vacuum tubes
- Performing condition testing of the thermal stability and operational parameters of a common-emitter amplifier circuit
- Performing condition testing of DC and audio amplifiers
- Defining electrical characteristics, applications and normal operational values of amplifiers
- Testing an amplifier for amplification
- Testing and repairing a vacuum tube amplifier
- Testing and repairing a transistor amplifier
- Identifying component parts and electrical characteristics of power supply circuits

- Identifying terms and definitions used to describe the components and operational characteristics of sound IF and AM circuits
- Performing condition testing and aligning to specifications the sound IF and AM circuits
- Identifying terms and definitions used to describe the components and operational characteristics of VHF and UHF tuner circuits
- Identifying terms and definitions used to describe the components and operational characteristics of automatic fine tuning (AFT) and remote control circuits
- Identifying terms and definitions used to describe the components and operational characteristics of automatic gain control (AGC) and noise cancelling circuits
- Identifying terms and definitions used to describe the components and operational characteristics of color television signal development, transmission, reception and decoding
- Performing a condition test of a picture tube and its associated circuits
- Identifying terms and definitions used to describe components and operational characteristics of band-pass amplifiers and circuits
- Identifying terms and definitions used to describe the components and operational characteristics of color sync circuits
- Identifying terms and definitions used to describe the components and operational characteristics of color demodulator and output amplifier circuits
- Troubleshooting defective color tuning circuits
- Performing condition testing and aligning to specifications color convergence circuits
- Performing condition test and calibration of volt-ohm-milliammeter (VOM)
- Performing condition test and calibration of electronic voltmeters (EVM)
- Performing condition test and calibration of tube testers
- Performing condition test and calibration of transistor testers
- Performing condition test and calibration of resistor substitution box
- Performing condition test and calibration of oscilloscopes
- Performing condition test and calibration of sine wave generators
- Performing condition test and calibration of square wave and pulse generators
- Performing condition test and calibration of frequency meters

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

Electronics Mechanic

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The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Electronics Mechanic.

ELECTRONICS MECHANIC
828.281-010

Observing electrical safety precautions
Identifying and using hand tools
Identifying and using sheet metal tools
Identifying and using power tools
Identifying volt-ohm-milliammeters (VOM)
Identifying and using electronic-volt meters (EVM)
Identifying and using ohmmeters
Identifying and using oscilloscopes
Identifying and using tube testers
Identifying and using transistor analyzers
Identifying and using capacitor testers
Identifying and using sine wave generators
Identifying and using signal generators
Identifying and using pulse generators
Identifying and using square wave generators
Identifying and using impedance testers
Identifying and using frequency meters
Understanding fundamentals of electrical theory and electrical measurement
Making calculations using Ohm's law
Measuring current in DC circuits
Measuring voltage in DC circuits
Calculating and measuring resistance in DC circuits
Calculating voltage, current and resistance in DC series circuits
Calculating total voltage, total current, and total resistance in DC parallel circuits
Calculating and measuring electrical quantities in combination DC circuits
Calculating power in DC circuits
Applying fundamentals of magnetism and electromagnetism
Using test instruments to measure voltage, current and resistance
Calculating values in DC network circuits
Calculating capacitance and time constants for RC circuits
Calculating values for a right triangle
Identifying the characteristics of AC sine waves
Measuring AC values for LF circuits
Determining reactance and impedance of a capacitor in either series or parallel circuits
Constructing and performing a condition test of oscillators
Testing and repairing oscillators
Testing and repairing clampers
Testing and repairing clipper circuits
Testing and repairing counters
Constructing and performing condition tests of pulse circuits
Testing and repairing nonsinusoidal wave shape amplifiers
Identifying electrical characteristics and operating values of amplitude modulators (AM) and AM detectors
Identifying electrical characteristics and operating values of frequency modulators (FM) and FM detectors
Constructing and performing condition testing of superheterodyne receivers
Identifying sequence and electrical characteristics of television signal development, transmission, reception and decoding
Identifying the components and electrical characteristics of a low voltage power supply and its protective circuit
Performing condition testing on a low voltage power supply
Troubleshooting a defective switch-mode secondary voltage supply
Troubleshooting defective synchronizing and deflection circuits
Troubleshooting defective horizontal output circuits
Troubleshooting sweep generator circuits
Troubleshooting a defective high voltage supply
Troubleshooting electronic circuits
Performing physical and electrical alignment of the picture tube and its associated circuits
Troubleshooting a defective vertical deflection circuit
Adjusting circuit operational conditions to obtain proper purity, focus and gray scale
Identifying terms and definitions used to describe the components and operational characteristics of video amplifiers
Troubleshooting defective video amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of video IF amplifiers
Performing condition testing and aligning to specifications RF and IF amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of sound IF and AM circuits

Calculating and measuring electrical values in AC capacitance circuits
Measuring inductance in series RL circuits
Computing turns, voltage, current and impedance ratios of transformers
Drawing phasor diagrams and calculating operating values for series AC circuits
Drawing phasor diagrams and calculating operating values for parallel AC circuits
Understanding fundamentals of tuned AC circuits
Understanding fundamentals of semi-conductor materials
Performing a condition test of a semi-conductor diode using an ohmmeter
Performing a condition test of zener diodes used in regulator circuits
Identifying symbols and electrical characteristics of tunnel varactor and high frequency diodes
Understanding the fundamentals of bipolar transistors and their electrical characteristics
Performing condition tests of bipolar transistors
Understanding the fundamentals of field effect transistors and their electrical characteristics
Understanding the fundamentals of thyristors and their electrical characteristics
Understanding fundamentals of integrated circuits
Defining the operating values and applications of optoelectronic devices
Identifying the component parts and operational characteristics of diode vacuum tubes
Identifying the component parts and operating characteristics of triode vacuum tubes
Identifying the component parts and operating characteristics of tetrode vacuum tubes
Identifying the component parts and operating characteristics of pentode vacuum tubes
Performing condition testing of the thermal stability and operational parameters of a common-emitter amplifier circuit
Performing condition testing of DC and audio amplifiers
Defining electrical characteristics, applications and normal operational values of amplifiers
Testing an amplifier for amplification
Testing and repairing a vacuum tube amplifier
Testing and repairing a transistor amplifier
Identifying component parts and electrical characteristics of power supply circuits
Testing and repairing power supplies
Calibrating power supply voltage

Performing condition testing and aligning to specifications the sound IF and AM circuits
Identifying terms and definitions used to describe the components and operational characteristics of VHF and UHF tuner circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic fine tuning (AFT) and remote control circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic gain control (AGC) and noise cancelling circuits
Identifying terms and definitions used to describe the components and operational characteristics of color television signal development, transmission, reception and decoding
Performing a condition test of a picture tube and its associated circuits
Identifying terms and definitions used to describe components and operational characteristics of band-pass amplifiers and circuits
Identifying terms and definitions used to describe the components and operational characteristics of color sync circuits
Identifying terms and definitions used to describe the components and operational characteristics of color demodulator and output amplifier circuits
Troubleshooting defective color tuning circuits
Performing condition testing and aligning to specifications color convergence circuits
Performing condition test and calibration of volt-ohm-milliammeter (VOM)
Performing condition test and calibration of electronic voltmeters (EVM)
Performing condition test and calibration of tube testers
Performing condition testing and calibration of transistor testers
Performing condition test and calibration of resistor substitution box
Performing condition test and calibration of oscilloscopes
Performing condition test and calibration of sine wave generators
Performing condition test and calibration of square wave and pulse generators
Performing condition test and calibration of frequency meters
Performing visual inspection of electronic equipment
Cleaning electronic equipment
Lubricating electronic equipment
Inspecting and replacing cords and cables
Inspecting and replacing tubes
Inspecting and replacing transistors
Inspecting and replacing IC units
Inspecting and replacing PC boards
Inspecting and repairing loudspeakers
Inspecting and repairing microphones

CERTIFICATE OF COMPETENCY

This is to Certify that

of

has successfully mastered the competencies required to perform the job of

Radio Electrician

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Radio Electrician.

RADIO ELECTRICIAN
823.281-014

Observing electrical safety precautions
Identifying and using hand tools
Identifying and using sheet metal tools
Identifying and using power tools
Identifying and using volt-ohm-milliammeters (VOM)
Identifying and using electronic-volt meters (EVM)
Identifying and using ohmmeters
Identifying and using oscilloscopes
Identifying and using tube testers
Identifying and using transistor analyzers
Identifying and using capacitor testers
Identifying and using sine wave generators
Identifying and using signal generators
Identifying and using pulse generators
Identifying and using square wave generators
Identifying and using impedance testers
Identifying and using frequency meters
Understanding fundamentals of electrical theory and electrical measurement
Making calculations using Ohm's law
Measuring voltage in DC circuits
Calculating and measuring resistance in DC circuits
Calculating voltage, current and resistance in DC series circuits
Calculating total voltage, total current and total resistance in DC parallel circuits
Calculating and measuring electrical quantities in combination DC circuits
Calculating power in DC circuits
Applying fundamentals of magnetism and electromagnetism
Using test instruments to measure voltage, current and resistance
Calculating values in DC network circuits
Calculating capacitance and time constants for RC circuits
Calculating values for a right triangle
Identifying the characteristics of AC sine waves
Measuring AC values for LF circuits
Testing and repairing a transistor amplifier
Identifying component parts and electrical characteristics of power supply circuits
Testing and repairing power supplies
Calibrating power supply voltage
Constructing and performing a condition test of oscillators
Testing and repairing oscillators
Testing and repairing clampers
Testing and repairing clipper circuits
Testing and repairing counters
Constructing and performing condition tests of pulse circuits
Testing and repairing nonsinusoidal wave shape amplifiers
Identifying electrical characteristics and operating values of amplitude modulators (AM) and AM detectors
Identifying electrical characteristics and operating values of frequency modulators (FM) and FM detectors
Constructing and performing condition testing of superhetiodyne receivers
Identifying sequence and electrical characteristics of television signal development, transmission, reception and decoding
Identifying the components and electrical characteristics of a low voltage power supply and its protective circuit
Performing condition testing on a low voltage power supply
Troubleshooting a defective switch-mode secondary voltage supply
Troubleshooting defective synchronizing and deflection circuits
Troubleshooting defective horizontal output circuits
Troubleshooting sweep generator circuits
Troubleshooting a defective high voltage supply
Troubleshooting electronic circuits
Performing physical and electrical alignment of the picture tube and its associated circuits
Troubleshooting a defective vertical deflection circuit
Adjusting circuit operational conditions to obtain proper purity, focus and gray scale
Identifying terms and definitions used to describe the components and operational characteristics of video amplifiers
Troubleshooting defective video amplifiers

Determining reactance and impedance of a capacitor in either series or parallel circuits
Calculating and measuring electrical values in AC capacitance circuits
Measuring inductance in series RL circuits
Computing turns, voltage, current and impedance ratios of transformers
Drawing phasor diagrams and calculating operating values for series AC circuits
Drawing phasor diagrams and calculating operting values for series AC circuits
Understanding fundamentals of tuned AC circuits
Understanding fundamentals of semi-conductor materials
Performing a condition test of a semi-conductor diode using an ohmmeter
Performing a condition test of zener diodes used in regulator circuits
Identifying symbols and electrical characteristics of tunnel, varactor and high frequency diodes
Understanding the fundamentals of bipolar transistors and their electrical characteristics
Performing condition tests of bipolar transistors
Understanding the fundamentals of field effect transistors and their electrical characteristics
Understanding the fundamentals of thyristors and their electrical characteristics
Understanding fundamentals of integrated circuits
Defining the operating values and applications of optoelectronic devices
Identifying the component parts and operational characteristics of diode vacuum tubes
Identifying the component parts and operating characteristics of triode vacuum tubes
Identifying the component parts and operating characteristics of tetrode vacuum tubes
Identifying the component parts and operating characteristics of pentode vacuum tubes
Performing condition testing of the thermal stability and operational parameters of a common-emitter amplifier circuit
Performing condition testing of DC and audio amplifiers
Defining electrical characteristics, applications and normal operational values of amplifiers
Testing an amplifier for amplification
Testing and repairing a vacuum tube amplifier

Identifying terms and definitions used to describe the components and operational characteristics of video IF amplifiers
Performing condition testing and aligning to specifications RF and IF amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of sound IF and AM circuits
Performing condition testing and aligning to specifications the sound IF and AM circuits
Identifying terms and definitions used to describe the components and operational characteristics of VHF and UHF tuner circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic fine tuning (AFT) and remote control circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic gain control (AGC) and noise cancelling circuits
Identifying terms and definitions used to describe the components and operational characteristics of color television signal development, transmission, reception and decoding
Performing a condition test of a picture tube and its associated circuits
Identifying terms and definitions used to describe components and operational characteristics of band-pass amplifiers and circuits
Identifying terms and definitions used to describe the components and operational characteristics of color sync circuits
Identifying terms and definitions used to describe the components and operational characteristics of color demodulator and output amplifier circuits
Troubleshooting defective color tuning circuits
Performing condition testing and aligning to specifications color convergence circuits
Performing visual inspection of electronic equipment
Cleaning electronic equipment
Lubricating electronic equipment
Inspecting and replacing cords and cables
Inspecting and replacing tubes
Inspecting and replacing transistors
Inspecting and replacing IC units
Inspecting and replacing PC boards
Inspecting and repairing loudspeakers
Inspecting and repairing microphones
Performing a proof of performance on electronic equipment
Keeping records on maintenance of equipment

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

Radio Mechanic

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The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Radio Mechanic.

RADIO MECHANIC
823.261-018

Observing electrical safety precautions
Identifying and using hand tools
Identifying and using sheet metal tools
Identifying and using power tools
Identifying and using volt-ohm-milliammeters (VOM)
Identifying and using electronic-volt meters (EVM)
Identifying and using ohmmeters
Identifying and using oscillscopes
Identifying and using tube testers
Identifying and using transistor analyzers
Identifying and using capacitor testers
Identifying and using sine wave generators
Identifying and using signal generators
Identifying and using pulse generators
Identifying and using square wave generators
Identifying and using impedance testers
Identifying and using frequency meters
Understanding fundamentals of electrical theory and electrical measurement
Making calculations using Ohm's law
Measuring voltage in DC circuits
Calculating and measuring resistance in DC circuits
Calculating voltage, current and resistance in DC series circuits
Calculating total voltage, total current and total resistance in DC parallel circuits
Calculating and measuring electrical quantities in combination DC circuits
Calculating power in DC circuits
Applying fundamentals of magnetism and electromagnetism
Using test instruments to measure voltage, current and resistance
Calculating values in DC network circuits
Calculating capacitance and time constants for RC circuits
Calculating values for a right triangle
Identifying the characteristics of AC sine waves
Measuring AC values for LF circuits
Testing and repairing a transistor amplifier
Identifying component parts and electrical characteristics of power supply circuits
Testing and repairing power supplies
Calibrating power supply voltage
Constructing and performing a condition test of oscillators
Testing and repairing oscillators
Testing and repairing clampers
Testing and repairing clipper circuits
Testing and repairing counters
Constructing and performing condition tests of pulse circuits
Testing and repairing nonsinusoidal wave shape amplifiers
Identifying electrical characteristics and operating values of amplitude modulators (AM) and AM detectors
Identifying electrical characteristics and operating values of frequency modulators (FM) and FM detectors
Constructing and performing condition testing of superhetiodyne receivers
Identifying sequence and electrical characteristics of television signal development, transmission, reception and decoding
Identifying the components and electrical characteristics of a low voltage power supply and its protective circuit
Performing condition testing on a low voltage power supply
Troubleshooting a defective switch-mode secondary voltage supply
Troubleshooting defective synchronizing and deflection circuits
Troubleshooting defective horizontal output circuits
Troubleshooting sweep generator circuits
Troubleshooting a defective high voltage supply
Troubleshooting electronic circuits
Performing physical and electrical alignment of the picture tube and its associated circuits
Troubleshooting a defective vertical deflection circuit
Adjusting circuit operational conditions to obtain proper purity, focus and gray scale
Identifying terms and definitions used to describe the components and operational characteristics of video amplifiers
Troubleshooting defective video amplifiers

Determining reactance and impedance of a capacitor in either series or parallel circuits
Calculating and measuring electrical values in AC capacitance circuits
Measuring inductance in series RL circuits
Computing turns, voltage, current and impedance ratios of transformers
Drawing phasor diagrams and calculating operating values for series AC circuits
Drawing phasor diagrams and calculating operting values for series AC circuits
Understanding fundamentals of tuned AC circuits
Understanding fundamentals of semi-conductor materials
Performing a condition test of a semi-conductor diode using an ohmmeter
Performing a condition test of zener diodes used in regulator circuits
Identifying symbols and electrical characteristics of tunnel, varactor and high frequency diodes
Understanding the fundamentals of bipolar transistors and their electrical characteristics
Performing condition tests of bipolar transistors
Understanding the fundamentals of field effect transistors and their electrical characteristics
Understanding the fundamentals of thyristors and their electrical characteristics
Understanding fundamentals of integrated circuits
Defining the operating values and applications of optoelectronic devices
Identifying the component parts and operational characteristics of diode vacuum tubes
Identifying the component parts and operating characteristics of triode vacuum tubes
Identifying the component parts and operating characteristics of tetrode vacuum tubes
Identifying the component parts and operating characteristics of pentode vacuum tubes
Performing condition testing of the thermal stability and operational parameters of a common-emitter amplifier circuit
Performing condition testing of DC and audio amplifiers
Defining electrical characteristics, applications and normal operational values of amplifiers
Testing an amplifier for amplification
Testing and repairing a vacuum tube amplifier
Identifying terms and definitions used to describe the components and operational characteristics of video IF amplifiers
Performing condition testing and aligning to specifications RF and IF amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of sound IF and AM circuits
Performing condition testing and aligning to specifications the sound IF and AM circuits
Identifying terms and definitions used to describe the components and operational characteristics of VHF and UHF tuner circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic fine tuning (AFT) and remote control circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic gain control (AGC) and noise cancelling circuits
Identifying terms and definitions used to describe the components and operational characteristics of color television signal development, transmission, reception and decoding
Performing a condition test of a picture tube and its associated circuits
Identifying terms and definitions used to describe components and operational characteristics of band-pass amplifiers and circuits
Identifying terms and definitions used to describe the components and operational characteristics of color sync circuits
Identifying terms and definitions used to describe the components and operational characteristics of color demodulator and output amplifier circuits
Troubleshooting defective color tuning circuits
Performing condition testing and aligning to specifications color convergence circuits
Performing visual inspection of electronic equipment
Cleaning electronic equipment
Lubricating electronic equipment
Inspecting and replacing cords and cables
Inspecting and replacing tubes
Inspecting and replacing transistors
Inspecting and replacing IC units
Inspecting and replacing PC boards
Inspecting and repairing loudspeakers
Inspecting and repairing microphones
Performing a proof of performance on electronic equipment
Keeping records on maintenance of equipment

CERTIFICATE OF COMPETENCY

This is to Certify that

of

has successfully mastered the competencies required to perform the job of

Electronics Technician

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Electronics Technician.

ELECTRONICS TECHNICIAN
003.161-014

Observing electrical safety precautions
Identifying and using hand tools
Identifying and using sheet metal tools
Identifying and using power tools
Identifying and using volt-ohm-milliammeters (VOM)
Identifying and using electronic-volt meters (EVM)
Identifying and using ohmmeters
Identifying and using oscilloscopes
Identifying and using tube testers
Identifying and using transistor analyzers
Identifying and using capacitor testers
Identifying and using sine wave generators
Identifying and using signal generators
Identifying and using pulse generators
Identifying and using square wave generators
Identifying and using impedance testers
Identifying and using frequency meters
Understanding fundamentals of electrical theory and electrical measurement
Making calculations using Ohm's law
Measuring current in DC circuits
Measuring voltage in DC circuits
Calculating and measuring resistance in DC circuits
Calculating voltage, current and resistance in DC series circuits
Calculating total voltage, total current and total resistance in DC parallel circuits
Calculating and measuring electrical quantities in combination DC circuits
Calculating power in DC circuits
Applying fundamentals of magnetism and electromagnetism
Using test instruments to measure voltage, current and resistance
Calculating values in DC network circuits
Calculating capacitance and time constants for RC circuits
Calculating values for a right triangle
Identifying the characteristics of AC sine waves
Measuring AC values for LF circuits
Determining reactance and impedance of a capacitor in either series or parallel circuits
Calculating and measuring electrical values in AC capacitance circuits
Measuring inductance in series RL circuits
Computing turns, voltage, current and impedance ratios of transformers
Drawing phasor diagrams and calculating operating values for series AC circuits
Constructing and performing condition testing of superhetiodyne receivers
Identifying sequence and electrical characteristics of television signal development, transmission, reception and decoding
Identifying the components and electrical characteristics of a low voltage power supply and its protective circuit
Performing condition testing on a low voltage power supply
Troubleshooting a defective switch-mode secondary voltage supply
Troubleshooting defective synchronizing and deflection circuits
Troubleshooting defective horizontal output circuits
Troubleshooting sweep generator circuits
Troubleshooting a defective high voltage supply
Troubleshooting electronic circuits
Performing physical and electrical alignment of the picture tube and its associated circuits
Troubleshooting a defective vertical deflection circuit
Adjusting circuit operational conditions to obtain proper purity, focus and gray scale
Identifying terms and definitions used to describe the components and operational characteristics of video amplifiers
Troubleshooting defective video amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of video IF amplifiers
Performing condition testing and aligning to specifications RF and IF amplifiers
Identifying terms and definitions used to describe the components and operational characteristics of sound IF and AM circuits
Performing condition testing and aligning to specifications the sound IF and AM circuits
Identifying terms and definitions used to describe the components and operational characteristics of VHF and UHF tuner circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic fine tuning (AFT) and remote control circuits
Identifying terms and definitions used to describe the components and operational characteristics of automatic gain control (AGC) and noise cancelling circuits
Identifying terms and definitions used to describe the components and operational characteristics of color television signal development, transmission, reception and decoding
Performing a condition test of a picture tube and its associated circuits
Identifying terms and definitions used to describe components and operational characteristics of band-pass amplifiers and circuits

Drawing phasor diagrams and calculating operating values for parallel AC circuits
Understanding fundamentals of tuned AC circuits
Understanding fundamentals of semi-conductor materials
Performing a condition test of a semi-conductor diode using an ohmmeter
Performing a condition test of zener diodes used in regulator circuits
Identifying symbols and electrical characteristics of tunnel varactor and high frequency diodes
Understanding the fundamentals of bipolar transistors and their electrical characteristics
Performing condition tests of bipolar transistors
Understanding the fundamentals of field effect transistors and their electrical characteristics
Understanding the fundamentals of thyristors and their electrical characteristics
Understanding fundamentals of integrated circuits
Defining the operating values and applications of optoelectronic devices
Identifying the component parts and operational characteristics of diode vacuum tubes
Identifying the component parts and operating characteristics of triode vacuum tubes
Identifying the component parts and operating characteristics of tetrode vacuum tubes
Identifying the component parts and operating characteristics of pentode vacuum tubes
Performing condition testing of the thermal stability and operational parameters of a common-emitter amplifier circuit
Performing condition testing of DC and audio amplifiers
Defining electrical characteristics, applications and normal operational values of amplifiers
Testing an amplifier for amplification
Testing and repairing a vacuum tube amplifier
Testing and repairing a transistor amplifier
Identifying component parts and electrical characteristics of power supply circuits
Testing and repairing power supplies
Calibrating power supply voltage
Constructing and performing a condition test of oscillators
Testing and repairing oscillators
Testing and repairing clampers
Testing and repairing clipper circuits
Testing and repairing counters
Constructing and performing condition tests of pulse circuits
Testing and repairing nonsinusoidal wave shape amplifiers
Identifying electrical characteristics and operating values of amplitude modulators (AM) and AM detectors
Identifying electrical characteristics and operating values of frequency modulators (FM) and FM detectors

Identifying terms and definitions used to describe the components and operational characteristics of color sync circuits
Identifying terms and definitions used to describe the components and operational characteristics of color demodulator and output amplifier circuits
Troubleshooting defective color tuning circuits
Performing condition testing and aligning to specifications color convergence circuits
Performing condition test and calibration of volt-ohm-milliammeter (VOM)
Performing condition test and calibration of electronic voltmeters (EVM)
Performing condition test and calibration of tube testers
Performing condition test and calibration of transistor testers
Performing condition test and calibration of resistor substitution box
Performing condition test and calibration of oscilloscopes
Performing condition test and calibration of sine wave generators
Performing condition test and calibration of square wave and pulse generators
Performing condition test and calibration of frequency meters
Performing visual inspection of electronic equipment
Cleaning electronic equipment
Lubricating electronic equipment
Inspecting and replacing cords and cables
Inspecting and replacing tubes
Inspecting and replacing transistors
Inspecting and replacing IC units
Inspecting and replacing PC boards
Inspecting and repairing loudspeakers
Inspecting and repairing microphones
Performing a proof of performance on electronic equipment
Keeping records on maintenance of equipment
Constructing PC boards
Designing voltage amplifiers
Designing wave shaping circuits
Designing logic circuits
Drawing electrical one-line diagrams from engineering sketches
Drawing electrical elementary diagrams from engineering sketches
Drawing electronic schematic diagrams from engineering sketches
Laying out, taping up and drawing basic printed circuit boards
Modifying schematics
Modifying circuits to accommodate IC's
Preparing assembly guides
Preparing parts lists
Preparing preliminary sketches
Drawing logic symbols
Making truth tables for logic gates
Determining meter movement, sensitivity and resistance
Extending the current range of a meter movement
Extending the voltage range of meter movement

SECTION VIII

SPECIAL NEEDS STUDENT

WORKING WITH SPECIAL NEEDS STUDENTS

Introduction

Special needs students are those who are designated as handicapped and/or disadvantaged. The 1976 vocational education amendment defines handicapped individuals as:

> Persons who are mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, seriously emotionally disturbed, orthopedically impaired, health impaired, or persons with other specific disabilities, who by reason thereof require special education and related services and who cannot succeed in the regular vocational education programs.

In Title II of the 1976 education amendments disadvantaged persons are defined as:

> Persons (other than handicapped persons) who have academic or economic disadvantages and who require special services, assistance or programs in order to enable them to succeed in vocational education programs.

Federal legislation requires that these special people be given an opportunity to function in a regular classroom. This section provides information on how special needs students are identified and how they can be mainstreamed into regular educational environments.

Figure One presents a model depicting various activities of the process in identifying and mainstreaming special needs students. These activities are conducted at three levels: the system level, the school level and the classroom level. All three levels must work together if implementation of the process is to be effective.

Identification Of The Special Needs Student

Through a variety of pre-testing procedures, special needs students are identified and their potentials are evaluated at the

SPECIAL NEEDS MAINSTREAMING MODEL

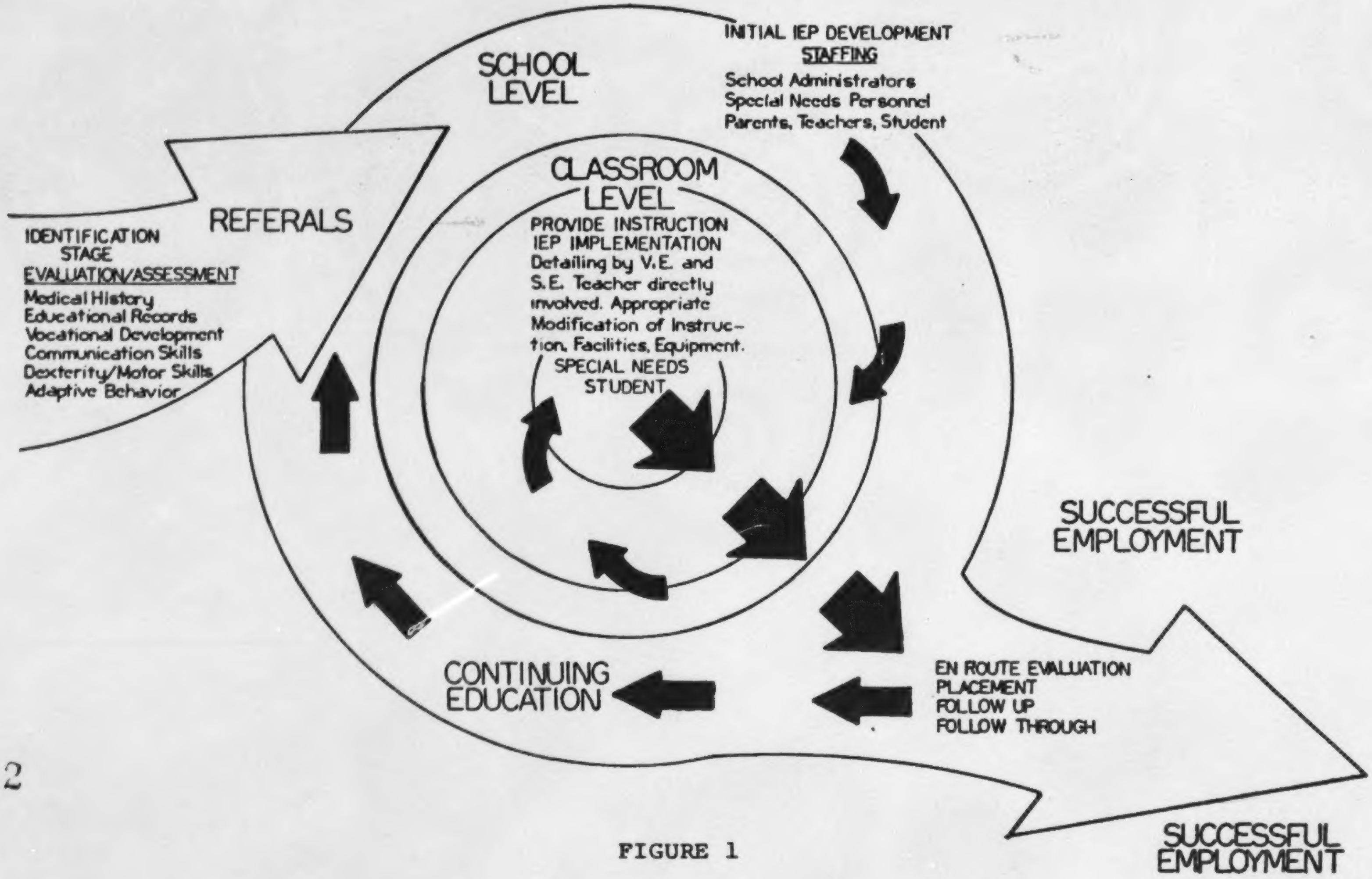

SCHOOL LEVEL
INITIAL IEP DEVELOPMENT
STAFFING
School Administrators
Special Needs Personnel
Parents, Teachers, Student
REFERALS
IDENTIFICATION STAGE
EVALUATION/ASSESSMENT
Medical History
Educational Records
Vocational Development
Communication Skills
Dexterity/Motor Skills
Adaptive Behavior
CLASSROOM LEVEL
PROVIDE INSTRUCTION
IEP IMPLEMENTATION
Detailing by V.E. and S.E. Teacher directly involved. Appropriate Modification of Instruction, Facilities, Equipment.
SPECIAL NEEDS STUDENT
SUCCESSFUL EMPLOYMENT
CONTINUING EDUCATION
EN ROUTE EVALUATION
PLACEMENT
FOLLOW UP
FOLLOW THROUGH
SUCCESSFUL EMPLOYMENT

FIGURE 1

system level. This evaluation process consists of collecting and assessing the following data for each student:

- Medical History
- Educational Records
- Vocational Development
- Communication Skills
- Dexterity/Motor Skills
- Adaptive Behavior

When this procedure has been completed, the system personnel refers the student to the appropriate school level personnel.

Development of the Plan

At the school level, an Individual Education Plan (IEP) is developed for each special needs student. An IEP is a written plan which describes the educational objectives, both long and short term, and the support services for a special needs student. The plan is developed by the school administration, special education personnel, teacher(s) directly involved with the student and the parent(s). In some cases, the student may help with the development.

Implementing the I.E.P.

The actual implementing of the I.E.P. begins at the classroom level. The purpose of the teacher dealing with the special needs student is to help the student set realistic goals, identify the barriers which make it difficult for the student to learn and adapt the curriculum and/or facilities with reference to the I.E.P. so the student can learn while overcoming personal barriers.

Special needs students have problems which hinder their learning. Therefore, a teacher's job becomes more complicated than when teaching "regular" students. Handicapped students may have a variety of problems - mental, physical and/or emotional.

Academically disadvantaged students may exhibit language deficiencies, reading and writing deficiencies, computational deficiencies and general educational deficiencies. Economically disadvantaged students may possess an inability to concentrate because their primary needs - food, shelter, clothing - are not adequately met due to lack of money.

By considering these problems, teachers can modify existing programs to accommodate the needs of special needs learners. Some suggestions which may prove beneficial in modifying an existing curriculum are listed below:

- Prepare instructional materials in greater detail and assign work in shorter units.
- Provide more frequent evaluation of student's progress and provide opportunities for remedial work.
- Be aware of the student's limited vocabulary.
- Be aware of the student's inability to understand abstractions and generalizations and prepare materials accordingly.
- Keep the student aware of his or her progress and make the student feel he or she can succeed.
- Use real teaching aids, live work and practical experiences whenever possible.
- Choose reading material which is at the student's level, interest and experience.
- Use constructive criticism only.
- Use peer instruction whenever possible.
- Allow the student to advance at his or her own pace.
- Use the part-to-whole learning concept in adapting materials.

Facility Modifications

In some cases, facilities, must be modified for handicapped special needs students. In general, as long as the classroom/

shop meets federal guidelines for barrier free design, extensive facility changes need not be made. For visually impaired students, for example, let the student locate in the classroom where he or she can see best even to the point of moving the desk or work station as a portable unit. In the case of orthopedically handicapped, some changes may have to be made to shop machinery to allow the student to use it. This may involve more convenient controls or special seating where the student would normally stand. In making these changes, special education expertise would be helpful.

Evaluation

Evaluation of the student's program should consist of:

- En-route evaluation (formative) to monitor the student's progress through the program.
- Summative evaluation upon completion of the program to determine job readiness.
- Follow-up after placement to determine if the student is successful on the job.
- Follow-through activities designed to identify any further training needed, which is indicated by the follow-up procedure.

Working with special needs students is much more demanding of the system, the school and the instructor. However, with their patience and understanding, special needs students can not only succeed, but in many cases excell.

RESOURCES

To aid the teacher in modifying materials for special needs categories, the following references are listed by category. These are suggested references only as a world of materials exist on this subject.

Mentally Retarded

A Curriculum Guide for Teachers of Educable Mentally Retarded. Danville, Ill.: The Interstate Printers and Publishing Co., Inc.

High, Elizabeth C., and Moyers, Kathy L. Training Manual: Developing Pre-Vocational/Vocational Skills in Developmentally Disabled Persons. Washington, D.C.: Job Development Laboratory, George Washington University, 1976.

Kolstoe, Oliver P. Teaching Educable Mentally Retarded Children. Holt, Rinehart and Winston, 1976.

Mulligan, Robert E.; Gavin, Donald and Conaley, James. Comprehensive Career Education Curriculum Guide for the Trainable. New Brunswick, N.J.: Rutgers Vocational-Technical Curriculum Laboratory, 1977.

Introduction to Vocations for Educable Mentally Retarded. New Jersey: New Jersey Department of Education.

State of Ohio Curriculum Guide for Moderately Retarded Learners. Columbus, Ohio: Ohio Department of Education, 1977.

Tucker, Mark M. Learning through Curriculum Modification; A Blueprint to Teaching the Mentally Retarded. Johnstown, PA.: Mafex Associates, Inc., 1976.

Watson, Marjorie. Mainstreaming the Educable Mentally Retarded. Washington, D.C., NEA, 1975.

Hearing Impaired

Alvin, Howard P. The Evolution of an Evaluation Design for Evaluating Secondary Programs for the Deaf in Vocational Occupational-Technical Education (VOTE) Programs. ERIC - ED 123-241.

Guidelines: Educational Planning for the Hearing Handicapped. North Carolina Public Schools. Division for Exceptional Children, North Carolina Department of Public Instruction, Raleigh, N.C., 1977.

Munson, Harold L.; Eglston, Judy Cobb and Phillips, Gordon B. Career Education for Deaf Students: An Inservice Leader's Guide. University of Rochester, College of Education, Center for the Study of Helping Services, Rochester, N.Y. 1975.

Nix, Gary W. Mainstreaming Education for Hearing Impaired Children and Youth. Grune and Stratton, 1976.

Orthopedically and Other Health

A Model Plan for a Cooperative Vocational Rehabilitation Program. Office of Human Development, Rehabilitation Services and Administration. Department of Health, Education and Welfare, Washington, D.C.

Mallix, Kalisanker and Mueller, Jim. Vocational Aids and Enhanced Productivity of the Severely Disabled. The George Washington University Rehabilitation Research and Training Center, Washington, D.C. 1975.

McCarthy, Henry and Smart, Landon. Recommendations for Enhancing Employment Prospects of Handicapped Individuals. Comps. Human Resources Center, Albertson, L. I., 1978.

Duncan, John, et al. Environmental Modifications for the Visually Impaired: A Handbook. Visual Impairment and Blindness, December 1977, p. 442-455.

Disadvantaged

Guidelines for Methods and Techniques of Teaching Disadvantaged Students. Division of Vocational Education, Virginia Polytechnic Institute and State University, Blackburg, VA.

A Handbook for Developing Programs and Services for Disadvantaged Students. Department of Vocational Education Studies, College of Education, Southern Illinois, University of Carbondale, Carbondale, Ill. 62901

By Program

Adaption of Home Economics Curricula for Special Needs. North Dakota Research Coordination Unit, State Board for Vocational Education, State Office Building, Bismarck, ND.

Auto Body: An Adaptive and Developmental Program for Special Needs Students. Vocational-Technical Curriculum Laboratory, Rutgers - The State University, New Brunswick, N.J. 1976.

Floriculture Board of Cooperative Educational Services of Nassaw County, Division of Occupational Education, Division of Special Education, Westburg, NY 1975.

Hull, Marc E., Berry, Owen J. and Clark, Donald L., Procedures for Teaching Vocational Concepts to Students with Special Needs. Texas A & M University, Final Report Project 62350274, June 1976.

Vocational Educational Resource Materials, A Bibliography of Materials for Handicapped and Special Education. Third edition, 1978. Wisconsin Vocational Studies Center, University of Wisconsin - Madison.

SECTION IX

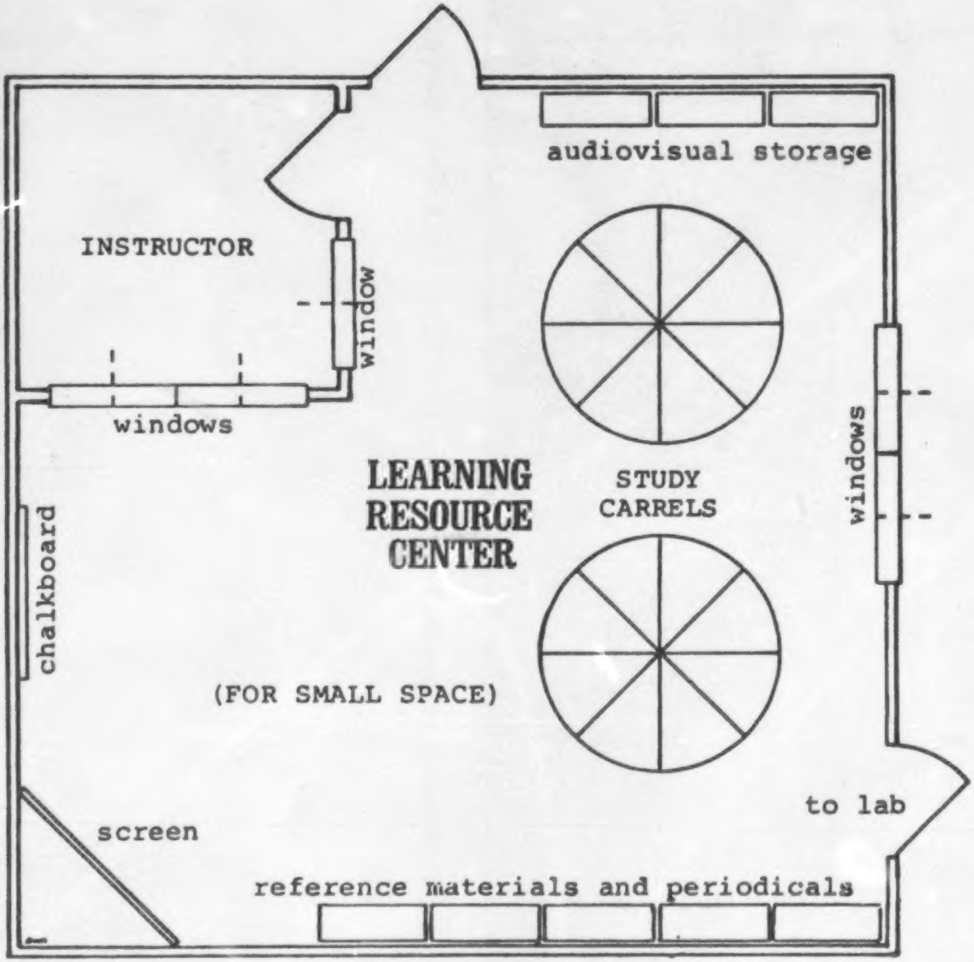
FACILITY LAYOUT

Facility Layout

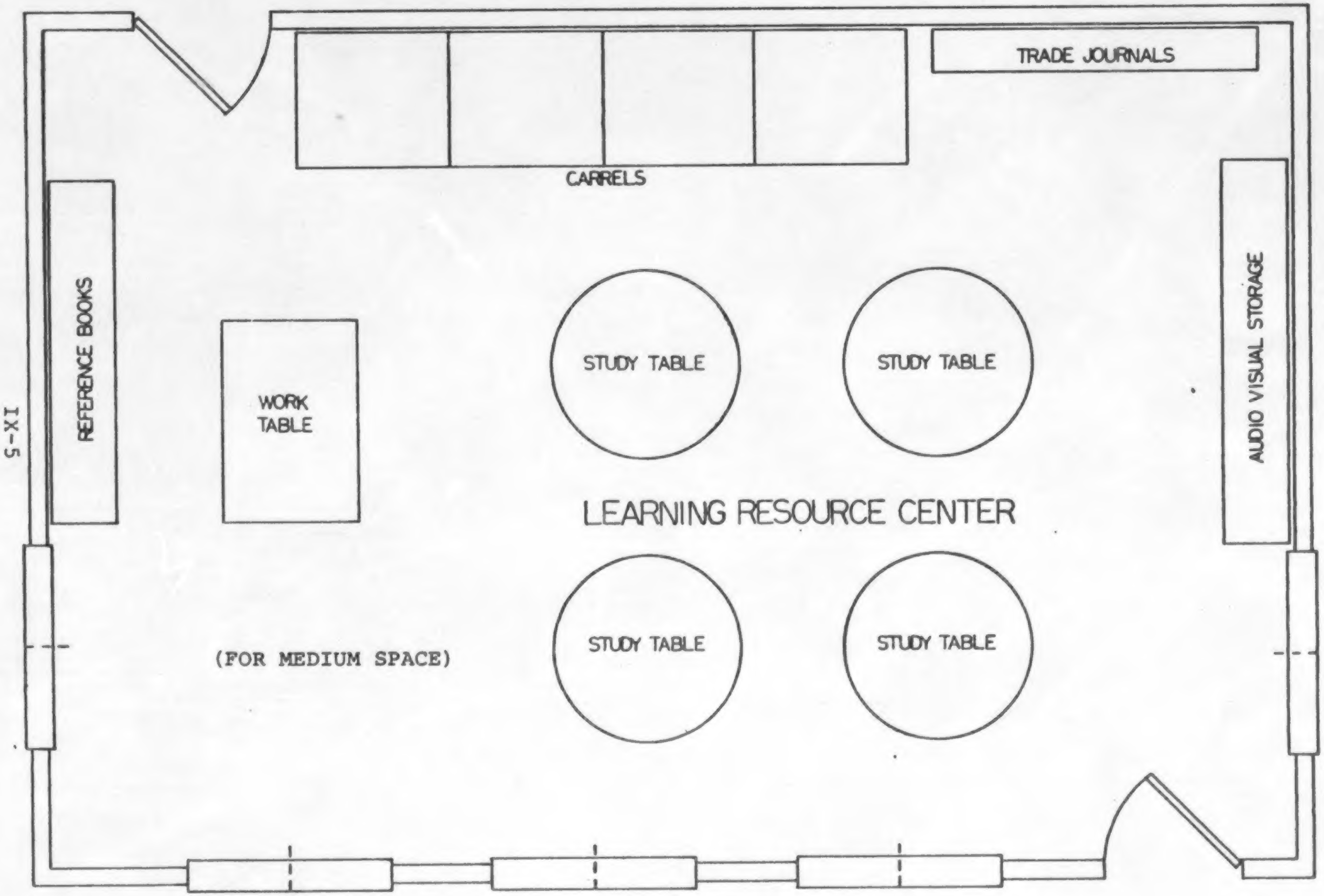
The facility layouts on the following pages are presented to aid in arranging the classroom and laboratory for efficient instruction. The three resource center arrangements represent small, medium and large centers. The instructor must determine an arrangement that best fits the needs of the students and the instructional method being used.

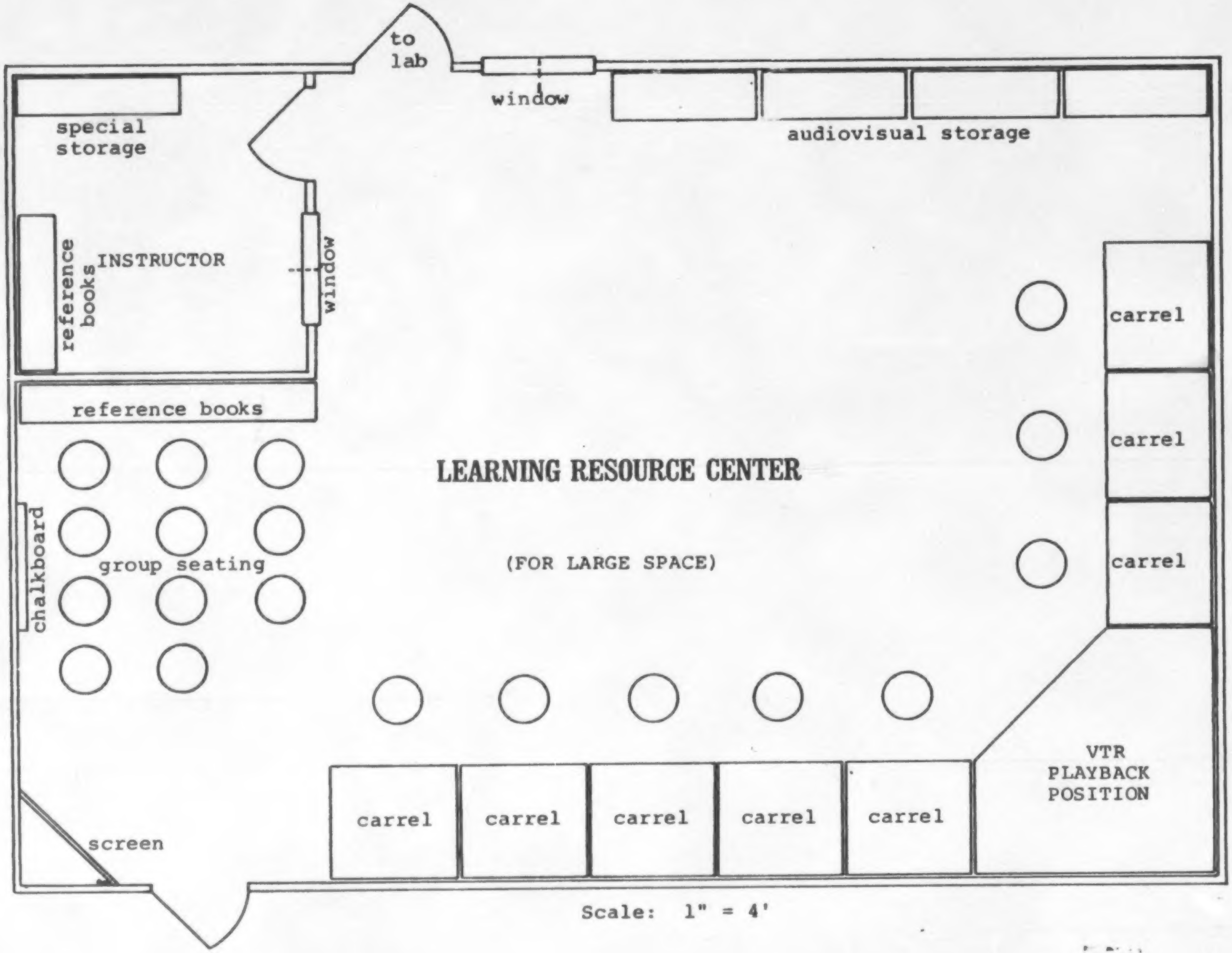
The laboratory facility layout is one recommended by the teachers who helped develop the Electronic Technology program materials. This facility is easily adaptable to a variety of arrangements that will best fit local needs.

These layouts may be especially useful in those schools where classroom renovation or construction is being planned.


audiovisual storage
INSTRUCTOR
window
windows
LEARNING RESOURCE CENTER
STUDY CARRELS
windows
chalkboard
(FOR SMALL SPACE)
to lab
screen
reference materials and periodicals

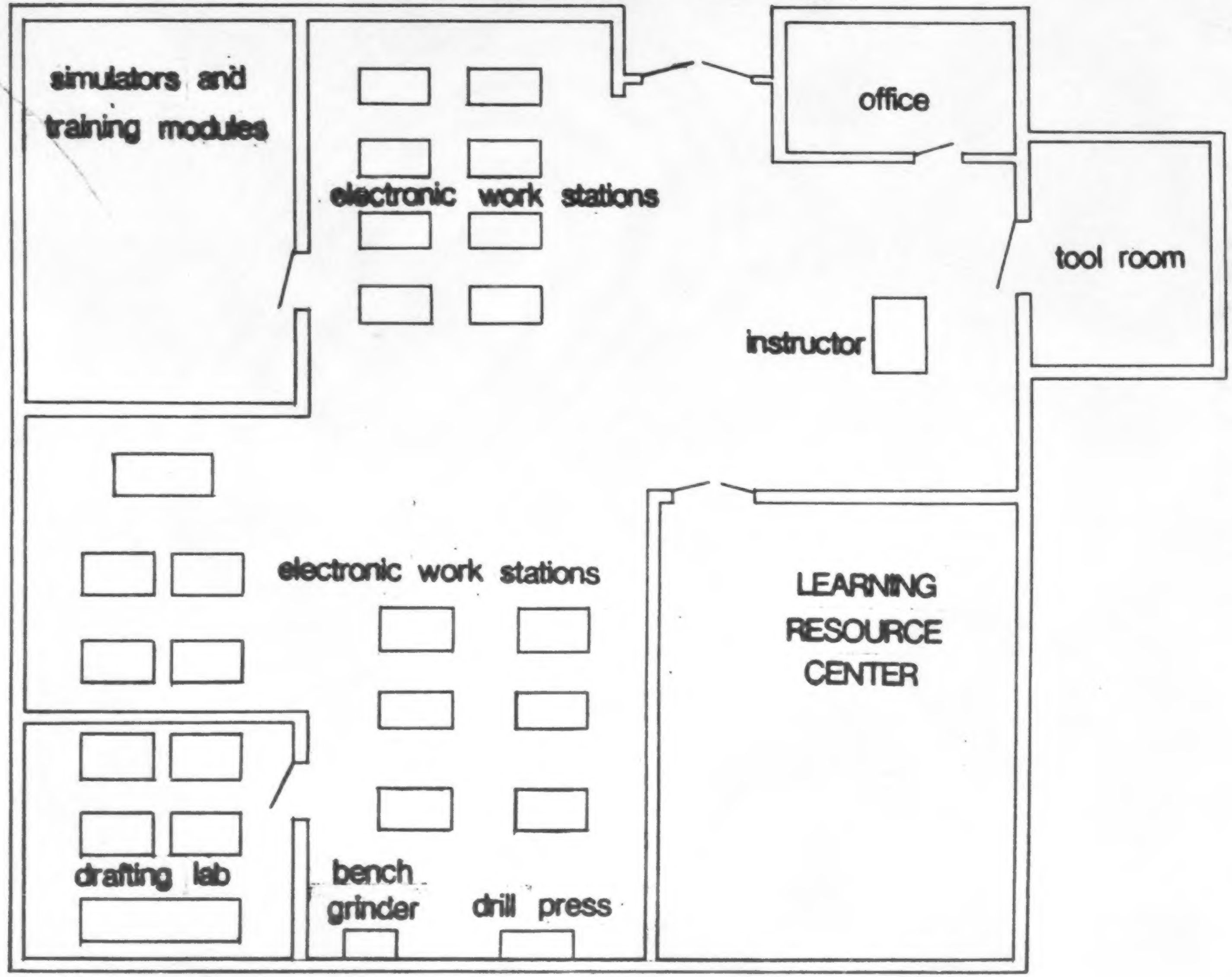
Scale: 1" = 4'


TRADE JOURNALS
CARRELS
REFERENCE BOOKS
WORK TABLE
STUDY TABLE
STUDY TABLE
AUDIO VISUAL STORAGE
LEARNING RESOURCE CENTER
(FOR MEDIUM SPACE)
STUDY TABLE
STUDY TABLE


to lab
window
audiovisual storage
special storage
reference books
INSTRUCTOR
window
reference books
LEARNING RESOURCE CENTER
(FOR LARGE SPACE)
chalkboard
group seating
carrel
carrel
carrel
VTR PLAYBACK POSITION
screen
carrel
carrel
carrel
carrel
carrel

Scale: 1" = 4'

ELECTRONIC TECHNOLOGY LABORATORY


simulators and training modules
electronic work stations
office
tool room
instructor
electronic work stations
LEARNING RESOURCE CENTER
drafting lab
bench grinder
drill press

557

558

SECTION X

DEFINITION OF TERMS

DEFINITION OF TERMS

1. AV's-Audiovisuals - May refer to any picture and/or sound media. (ie. slides, tapes, filmstrips, 16 mm films, etc.)

2. Checkpoint - A student-instructor interface point wherein the instructor may give the student a test, perform a demonstration, or simply provide the student with additional needed information or instructions. Also a checkpoint may be used for motivational purposes.

3. Competency - The ability (knowledge, skills and attitudes) to perform all of a group or cluster of related tasks required to complete a designated activity according to occupational standards. In the educational setting the statement of a competency includes expected student outcomes in terms of knowledge, skills, and attitudes required to complete a designated activity as defined by incumbent workers according to the standards of the work place.

4. Course - A grouping of tasks and competencies which have a common knowledge base or are within a given domain.

5. Criterion-Referenced Measure - An exercise based upon a performance objective, the accomplishment of which measures attainment of that objective.

6. Criterion-Referenced Test - A test designed to measure student competencies based on job or industrial standards.

7. Curriculum Guide - A document containing the objectives, content, organization, and structure of an instructional program. It is designed for use by administrators, instructional supervisors and teachers.

8. D.O.T. - Abbreviation for Dictionary of Occupational Titles. Document provides nine digit codes identifying each occupation.

9. Duty - One of the distinct major activities involved in the work performed, comprising related tasks.

10. Exit Point - A predetermined point within an instructional program in which a student may exit with the essential competencies for a specific job. Usually defined in terms of D.O.T. codes and/or O.E. codes.

11. "Hands-On" - Statement implying the student is physically involved in a learning activity.

12. Individualized Instruction (I.I.) - A system of instruction allowing for a student to progress at their fastest rate.

13. Job - A specific area of specialization within an occupational field consisting of several closely related duties for which a person would expect to receive remuneration. Should be identified by DOT code.

14. Job Sheet - (Or Operations Sheet) - A project of a performance nature. Generally performed by the student in a lab or shop type environment or in a specialized work area.

15. Live Work - Generally refers to items brought into the course area for repair or adjustment. Examples of live work might be automobiles, radios and TV's, air-conditioners, etc. Another form of live work would be patrons visiting the cosmetology department to receive permanents or other services.

16. Master Copies - Original copies of slides, tapes or written materials set aside for the purpose of duplication.

17. Occupational Cluster - A group of occupations sharing a common core of competencies. Georgia's comprehensive high school vocational program is organized around this concept.

18. Occupational Inventory - A listing of tasks to be performed in a particular occupational area, grouped under duty classifications.

19. O.E. - Refers to the U. S. Office of Education. O.E. codes are a classification system (taxonomy) for occupational education programs.

20. Open Entry - Term meaning that a student may enter the program at any time and does not have to wait for quarter or semester breaks.

21. Open Exit - Term meaning that a student may leave a program any time he/she completes their occupational objective.

22. Performance Guide - A series of steps, arranged in a sequence ordinarily followed, which when completed may result in the performance of a task. Also called "teaching steps."

23. Performance Objective - A statement in precise, measurable terms of a particular behavior to be exhibited by a learner under specified conditions. It possesses each of the elements or characteristics specified below:

    a. Condition - The testing situation confronting the learner is clearly specified. This includes equipment provided or withheld, environmental constraints such as temperature, space, etc.

   b. Performance - The specific behavior expected of the learner is stated.

   c. Standard - The degree of acceptable performance is specified.

24. Performance Test - A test entailing not only the ability to answer questions, but measuring the students' ability to operate, manipulate, or perform a given task as well.

25. Program - An organized sequence of courses leading to an occupational objective. A program may contain one or more student exit points as defined by D.O.T. codes.

26. Program Objective - The outcome of a prescribed program of instruction. Usually expressed in terms of the occupation or job for which training is designed. D.O.T. codes are frequently used to identify program objectives or student exit points.

27. Self-Paced - Refers to a student moving through the prescribed training program at the fastest pace at which the student can meaningfully learn.

28. Sequencing - Putting any set or series of learning activities or tasks into proper order or sequence. Normally arranged from the simple to complex within groupings or blocks.

29. Software - Written or printed materials, slides, filmstrips, tapes, etc.

30. Student Manual - A document designed for use by students in a specific instructional program. It contains unit sheets, references, operational procedures or job sheets, etc.

31. Task - The smallest division of work in which a measurable output occurs. A logical and necessary step in the performance of a duty.

32. Task List - A listing of tasks performed by incumbent workers within a domain of interest. An example is a listing of all tasks performed by an automotive mechanic or by a worker in ornamental horticulture.

33. Unit - One "module" training materials; generally covering one learning task and programmed on one Unit Sheet. May cover more than one lesson.

34. Unit Guide - A curriculum guide sheet that lists a task and objective with the instructional activities, instructional materials, evaluation and approximate time required for a student to successfully complete the task.

35. V-TECS Catalog - A comprehensive collection of performance objectives, performance guides, criterion-referenced measures, and related data, organized by a job structure or career ladder within a domain of interest.

Federal law prohibits discrimination on the basis of race, color or national origin (Title VI of the Civil Rights Act of 1964); sex (Title IX of the Educational Amendments of 1972 and Title II of the Vocational Education Amendments of 1976); or handicap (Section 504 of the Rehabilitation Act of 1973) in educational programs or activities receiving federal financial assistance.

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The following individuals have been designated as the employees responsible for coordinating the department's effort to implement this nondiscriminatory policy.

Title II - Loydia Webber, Vocational Equity Coordinator
Title VI - Peyton Williams Jr., Associate Superintendent of State Schools and Special Services
Title IX - Evelyn Rowe and Myra Tolbert, Coordinators
Section 504 - Jane Lee, Coordinator of Special Education

Inquiries concerning the application of Title II, Title VI, Title IX or Section 504 to the policies and practices of the department may be addressed to the persons listed above at the Georgia Department of Education, State Office Building, Atlanta 30334; to the Regional Office for Civil Rights, Atlanta 30323; or to the Director, Office for Civil Rights, Education Department, Washington, D.C. 20201.